EMCSF
2.2 V1

Remedial Investigation/Feasibility Study

Work Plan

Prepared for:
FMC Corporation
J.R. Simplot Company

for the
Eastern Michaud Flats Site

June 1992

Copy No. 52

Bechtel
Bechtel Environmental, Inc.

July 23, 1992

Mr. Bill Adams
M/S HW-113
U. S. Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, WA 98101

Subject: Eastern Michaud Flats RI/FS
Work Plan, Sampling and Analysis Plan, Health and Safety Plan Reserve

Dear Mr. Adams:

Per your request, enclosed are four additional copies of the Eastern Michaud Flats Task 1 Deliverables. These include the Work Plan (dated June 15, 1992), the Sampling and Analysis Plan (dated February 28, 1992) and Sampling and Analysis Plan Addendum (dated June 15, 1992), and the Health and Safety Plan (dated February 28, 1992).

Sincerely yours,

John R. Kulley for
Earl C. Mapes
J. R. Simplot Company

John R. Kulley for
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FMC Corporation
Phosphorus Chemicals Division

cc: Mike Thomas, ID Dept. of Health and Welfare, Div. of Environ. Quality
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1. Introduction

Section 1
Introduction

This Work Plan outlines tasks to be performed in conducting a remedial investigation/feasibility study (RI/FS) for the Eastern Michaud Flats (EMF) site. Work described in this plan is being performed under an Administrative Order on Consent (AOC) issued by the U.S. Environmental Protection Agency (EPA) on May 30, 1991. The EMF site was placed on the National Priorities List (NPL) on August 30, 1990 (*Federal Register*, Vol. 55, No. 169, pp. 35502-35525).

As stated in the AOC, the RI/FS will: "(a) determine the nature and extent of contamination at and from the Site, and the nature and extent of any threat to the human health, welfare, or the environment presented by the release or threat of release of hazardous substances, pollutants, or contaminants at or from the Site, by conducting a remedial investigation; (b) determine and evaluate alternatives for remedial action to prevent, mitigate, or otherwise respond to any release or threat of release of hazardous substances, pollutants, or contaminants from the Site, by conducting a feasibility study..." (EPA, 1991).

The EMF site was placed on the NPL largely due to evidence of elevated metals concentrations, particularly arsenic, in the shallow groundwater beneath the FMC and Simplot facilities, coupled with the existence of a City of Pocatello municipal water supply well approximately 3 miles to the east. The RI described in this Work Plan will further define groundwater quality and movement beneath the EMF site to better assess the potential impacts of the two facilities on the local groundwater environment. The RI will also assess the potential impacts of the two facilities on soils, surface water, and air.

Drafts of this Work Plan were submitted to EPA on August 28, 1991 and February 28, 1992. EPA approved portions of the earlier drafts conditioned upon FMC and Simplot providing adequate responses to comments related to these portions of the Work Plan. Consequently, the Potentially Responsible Parties (PRPs) have already initiated work on some portions of the plan, notably the subsurface investigation described in Work Plan Sections 6.4 and 6.5, the surface water and sediment investigation described in Section 6.6, and the ecological survey described in Section 6.8.

1.1 EASTERN MICHAUD FLATS SITE

The EMF site, the eastern boundary of which is approximately 2.5 miles northwest of Pocatello, Idaho, includes approximately 2,600 acres in Power and Bannock counties. Within the EMF site are two adjacent phosphate ore processing facilities, the FMC Corporation Elemental Phosphorus Plant (FMC) and the J. R. Simplot Company Don Plant (Simplot). Both are active operating facilities. The FMC and Simplot facilities occupy parts of the northern portions of Sections 19 and 24, the majority of Sections 13, 14, and 18, and the southern portions of Sections 7 and 12 in Township 6 South, Range 33 East and Range 34 East. The EMF site also includes certain areas, currently undefined, which are outside the battery limits (plant boundaries) of the two operating facilities. An EMF site location map is shown in Figure 1-1.

1.2 WORK PLAN ORGANIZATION

This RI/FS Work Plan consists of 10 sections including this Introduction. Section 2 provides a description of the FMC and Simplot facilities and a summary of their plant operations. The wastes generated at the FMC and Simplot facilities are also summarized. Section 3 describes the regional and site-specific environmental setting of the EMF site and chronicles previous investigations performed at the site and at the FMC and Simplot facilities. Section 4 describes the EMF conceptual site model, and provides a preliminary discussion of remedial objectives, actions, and technologies as well as potential operable units and Applicable or Relevant and Appropriate Requirements (ARARs).

Section 5 presents a discussion of data needs and data quality objectives, describes the work tasks associated with the RI/FS activities, and identifies deliverables associated with each task. Section 6 presents the scope of work for Phase I of the EMF site RI. Section 7 summarizes the management approach that will be followed

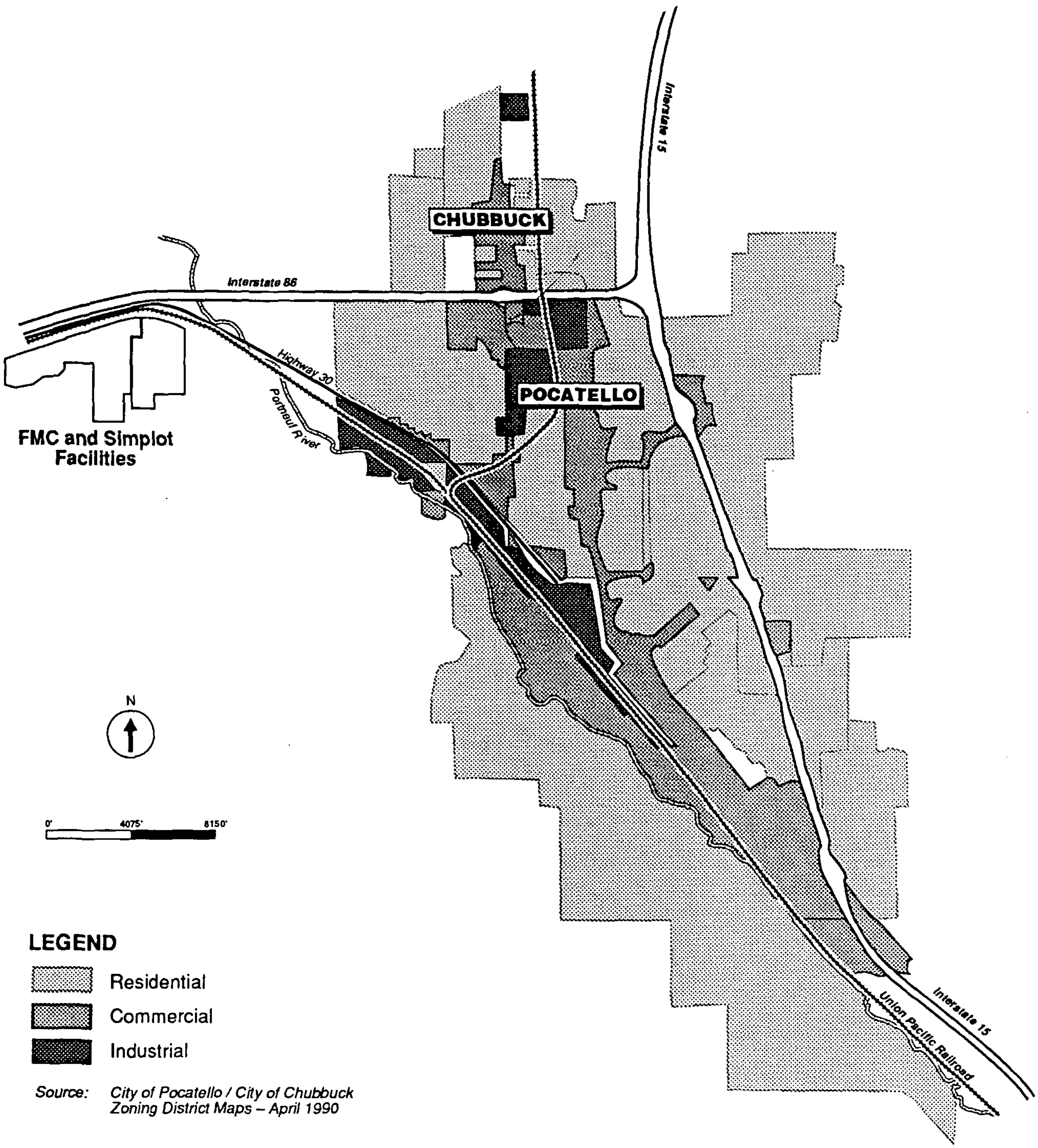

Figure 1-1 FMC and Simplot Facilities Location

for the performance of this project. Section 8 provides the overall schedule for the performance of RI/FS activities. Section 9 outlines a plan for the organization, storage, and management of data generated during field investigations at the EMF site. Section 10 lists the references used to generate this Work Plan.

1.3 DISCLAIMERS

FMC Corporation and the J. R. Simplot Company have had this Work Plan prepared solely for purposes of complying with the May 30, 1991 Administrative Order on Consent between the companies and Region 10 of the U.S. Environmental Protection Agency. Nothing contained herein constitutes an admission or waiver of any kind, and specifically neither company is responsible for statements made in this Work Plan concerning conditions at the other company's facility.

Bechtel Environmental, Inc. (BEI) is not responsible for the accuracy of information which has been furnished to BEI by FMC Corporation, J. R. Simplot Company, or by third parties, but reserves the right to rely on such information in preparing this plan.

2. Facility and Waste Descriptions

Section 2

Facility and Waste Descriptions

This section provides a description of the FMC and Simplot facilities and a summary of their plant operations. The wastes generated at each of the facilities are also discussed. Sections 2.1 and 2.2 provide a description of the FMC and Simplot facilities. Descriptions of wastes generated at each of the facilities are presented in Sections 2.3 and 2.4.

2.1 FMC FACILITY DESCRIPTION

This section provides a brief description of the FMC facility and a summary of plant operations.

2.1.1 General Facility Description

The FMC facility is located approximately 3 miles northwest of Pocatello, Idaho, in Township 6 South, Range 33 East (USGS, 1971a) where it occupies portions of Sections 12, 13, 14, and 24 on the Fort Hall Indian Reservation. The easternmost portion of the facility, located off the reservation, is in Township 6 South, Range 34 East, Sections 7 and 18. The facility lies approximately 1 mile southwest of the Portneuf River, a tributary of the Snake River. The facility covers approximately 1,500 acres and adjoins the western boundary of the Simplot facility. The FMC facility plan is shown in Figure 2-1.

A Union Pacific Railroad right-of-way parallels the northern property line of the facility. Access to the facility is provided by Interstate Highway 86 and U.S. Highway 30.

2.1.2 Summary of Operations

The FMC facility has been in continuous operation since its construction in 1949. The plant produces elemental phosphorus from rock mined regionally from the Phosphoria Formation. Raw ore is formed into briquets, hardened, mixed with silica and coke, and fed into electric arc furnaces. The elemental phosphorus is given off in a gaseous form which is condensed to a liquid, stored in tanks, and loaded into rail cars for shipment. Because of the unique properties of phosphorus, waste streams generated during the process must be handled with special care to protect the health and safety of the work force.

The plant is physically organized around three major components: the administration complex, the Burden business, and the Phos business. The administration complex consists of the main office building, technical support (laboratory) building, change house, lunchroom, and data processing building. The Burden business, which handles the raw ore until it is mixed into the burden furnace feed, consists of the car dumper, stacker/reclaimer, and screening, crushing, briquetting, and calcining areas. The Phos business handles phosphorus production which takes place in the proportioning building, furnace building, and phosphorus loading dock (referred to as the phos dock). Support structures include mobile shops, power substations, maintenance buildings, and boiler plants.

Elemental phosphorus, which burns spontaneously in air, must be handled in an oxygen-depleted environment to prevent oxidation. Industry practice, for safety reasons, is to handle elemental phosphorus products and waste as a water slurry or under water to prevent exposure to ambient air. This practice results in numerous surface impoundments containing differing quantities of phosphorus-bearing sediments. At the FMC facility there are seven active surface impoundment units that are subject to hazardous waste regulation. These units are designated as waste management units (WMUs) and are documented in FMC's RCRA Part B permit application submitted to EPA, Region 10, on February 27, 1991 (FMC, 1991a).

Process operations at the FMC facility include ore handling and preparation, furnace feed preparation, furnace operation, and byproduct handling. A general flow diagram summarizing these operations is presented in Figure 2-2.

2.1.2.1 *Ore Handling and Preparation*

Shale ore containing phosphorus is shipped from the Shoshone-Bannock Tribe's Gay Mine to FMC via rail car during the summer, and is stored in a shale pile for

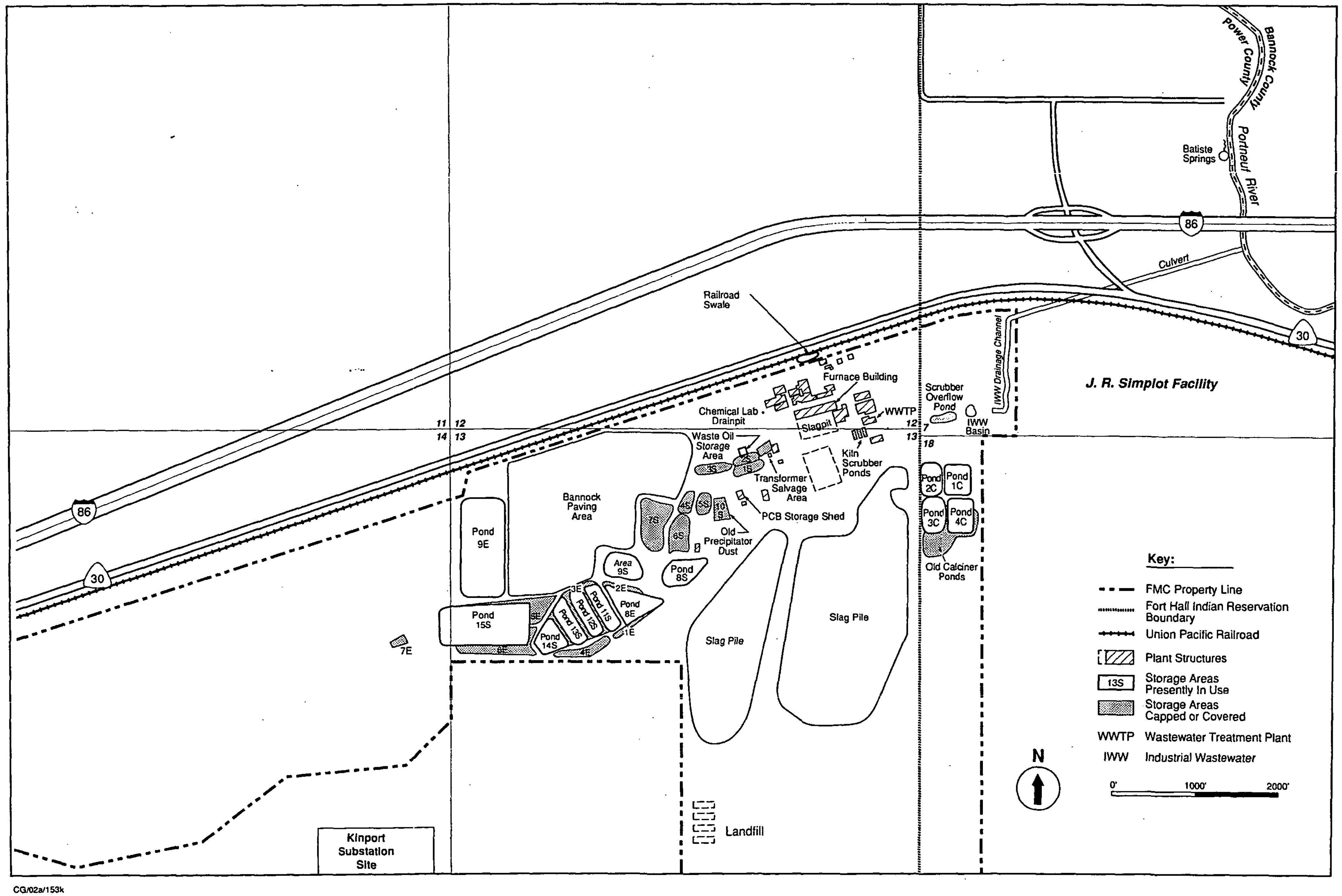

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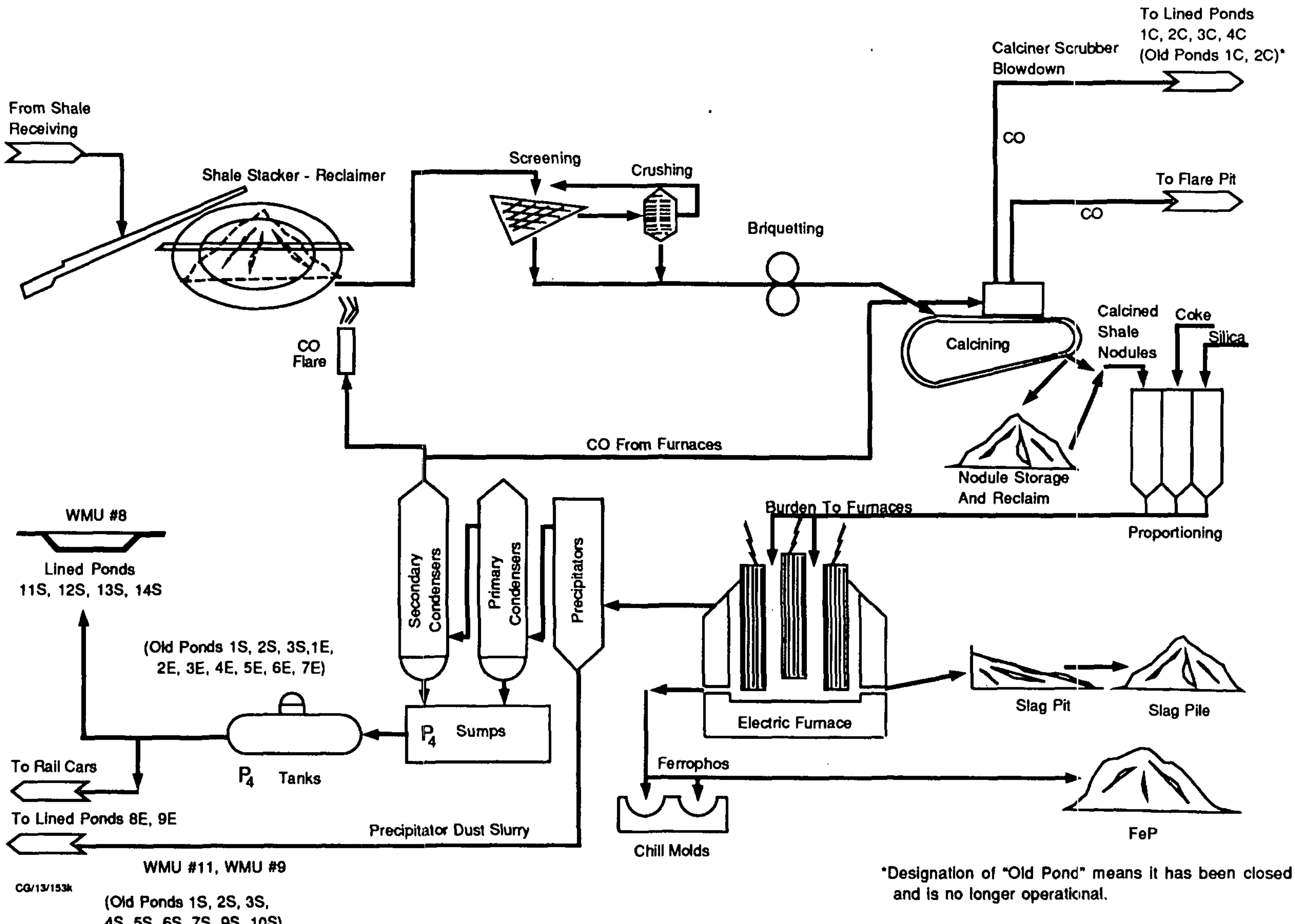
Figure 2-1 FMC Facility Plan



*Designation of "Old Pond" means it has been closed and is no longer operational.

Figure 2-2 FMC General Flow Diagram

processing. The Gay Mine is located approximately 30 miles northeast of Pocatello on the Fort Hall Indian Reservation. Because shale cannot be shipped during the winter months, a stockpile is built up over the summer from which to work during the winter. The shale is blended, reclaimed, screened, crushed, and sorted to provide a consistent size for forming into briquets. The annual plant shale use is approximately 1.5 million tons.

The briquetting process uses continuous roll presses to form the shale into briquets the size of charcoal briquets. These briquets then pass through the calciners where they are heated to a temperature of 1600 to 2300°F to drive off the moisture and organic materials. This process results in heat-hardened nodules which are used as furnace feed material..

The plant has two continuous-grate calciners that operate in parallel. The soft briquets are placed on moving grates and carried through the calcining zone, the cooling zone, and then either stockpiled as nodules or conveyed to bins in the proportioning building. Fuel for the calcining zone is primarily carbon monoxide gas which is a byproduct of the furnace operation. Natural gas is used as a backup source of fuel. The cooling zone uses ambient air.

Each calciner has two wet scrubbers in parallel to provide particulate removal from the calciner off-gas stream. Secondary scrubbers are located downstream of each of the existing scrubbers and further reduce air emissions of particulate and naturally occurring radionuclides. These are also wet scrubbers and use John Zink Hydro-sonic® tandem nozzle scrubbers and cyclone separators. The blowdown liquid of the calciner scrubbers (500 gallons per minute from the first set of scrubbers and 200 gallons per minute from the second set of scrubbers) is treated for pH in a wastewater treatment unit and sent to a surface impoundment (Pond 1C, 3C, or 4C) for settling and ultimate recycle for use in the wet scrubbers. Pond 2C is a surge pond used to recycle water back to the scrubbers.

The proportioning process blends the calcined briquets with silica and coke in the proper proportions to form the furnace feed. Annual quantities of silica and coke utilized are up to 100,000 tons and 180,000 tons, respectively. Each furnace may have a differently proportioned feed called the burden. The furnace feed is then conveyed to the burden level (the top entry to the feed bins) of the furnace building.

2.1.2.2 *Furnace Operation*

The furnace operation is considered the central processing step for the production of elemental phosphorus. The calcined briquets, silica, and coke are introduced into the four electric arc furnaces by gravity feed from the furnace feed bins located above the furnaces. Each furnace is equipped with three carbon electrodes through which power is fed to the furnaces resulting in a reaction zone with temperatures ranging from 2300 to 2700°C.

The furnace reaction yields elemental phosphorus, carbon monoxide, calcium silicate (slag), and ferrophosphorus (ferrophos). The phosphorus exits the furnace in a gaseous form along with the carbon monoxide. These furnace gases are cleaned of entrained dust in a two-stage electrostatic precipitator process and then condensed in a water spray condenser to recover the elemental phosphorus. The molten phosphorus is collected in a sump below ground and processed at the phos dock. Current annual production of phosphorus is about 240 million pounds. The carbon monoxide gas is sent through a secondary condenser for maximum recovery of elemental phosphorus before being sent to the calciner for use as fuel. The precipitator dust is slurried with clarified phossy water and pumped to the precipitator slurry interim storage pond (8E) and ultimately to the precipitator slurry drying pond (9E). The excess process water used in the condensers is sent to the phos dock for phosphorus recovery processing and reuse, and then out to the Phase IV ponds, where it is clarified and recycled.

The molten material that remains in the furnace as part of this phosphorus production process consists of calcium silicate slag and ferrophos, which is a phosphorus and iron alloy. Both the slag and ferrophos are tapped from each furnace several times per day through separate tap holes which allow the molten material to flow out of the furnace and to be collected separately. The tapping process is performed in a hood-type arrangement to allow for collection of the fumes generated as part of the tapping process. These fumes first pass through a Medusa wet venturi action scrubber and then Andersen filter dry scrubbers. The liquid from the Medusa and Andersen scrubbers is sent to a wastewater treatment unit where it undergoes lime treatment to adjust the pH to 4.7 or higher before it is sent to the calciner ponds where it is clarified and recycled back to the calciner scrubbers. Used Andersen filter media is treated at the Andersen filter media wash station. This treatment renders the waste nonhazardous. Although FMC is currently handling and disposing this material as a hazardous waste, this practice will change in the near future. Additional information on the Andersen filter media wash station will be provided to EPA in the revised RCRA Part B Permit Application.

The elemental phosphorus condensed to a liquid state is then stored in tanks in the phos dock area where it is loaded into rail cars for shipment or put into underground tanks for long-term storage. The phosphorus must be stored under a water cover to prevent the oxidation of the phosphorus upon exposure to air.

2.1.2.3 *Byproduct Handling*

The main byproduct streams generated at FMC are carbon monoxide, slag, and ferrophos.

Carbon monoxide is produced in the chemical reaction that takes place in the furnace, and passes through the secondary condenser for further phosphorus recovery. It is then burned in the calciner for fuel or flared.

The molten slag runs into the slag pit where it cools and is continuously loaded into haul trucks that move it to the slag pile.

The ferrophos is collected in sand molds and cooled in the furnace building, stored on site, and sold.

2.2 SIMPLOT FACILITY DESCRIPTION

This section provides a brief description of the Simplot facility and a summary of plant operations.

2.2.1 General Facility Description

The J. R. Simplot Company Don Plant, located approximately 2.5 miles west of Pocatello, Idaho, began production of single superphosphate fertilizer in 1944. Phosphoric acid production began in 1954. The facility covers approximately 1,130 acres and adjoins the eastern property boundary of the FMC facility. A site plan of the Simplot facility is provided in Figure 2-3.

2.2.2 Summary of Operations

The Simplot plant produces phosphoric acid from phosphate ore using a wet (aqueous) process. Phosphate ore was formerly transported from the Gay, Conda, and Smoky Canyon mines to the plant via rail car. As of September 1991, the Simplot plant began receiving phosphate ore solely from the Smoky Canyon mine through a slurry pipeline. The phosphate ore is beneficiated (physically washed) at the Smoky Canyon phosphate mining/processing plant before it is transported via a buried slurry pipeline to the Simplot facility. At the mining/processing/plant, the ore is crushed and washed. Fine and coarse materials generated from the crushing process are then separated in sequence by classifiers and a hydroclone system. The beneficiation process yields a 31 percent P_2O_5 concentrate suitable for production of phosphoric acid.

Upon arrival at the plant, slurried phosphate ore is thickened to approximately 70 percent solids content before being stored in agitated tanks. It is pumped directly into the phosphoric acid reactor from the storage tanks. The phosphoric acid is further processed into a variety of solid and liquid fertilizers. The plant produces twelve principal products including five grades of solid fertilizers and four grades of liquid fertilizers.

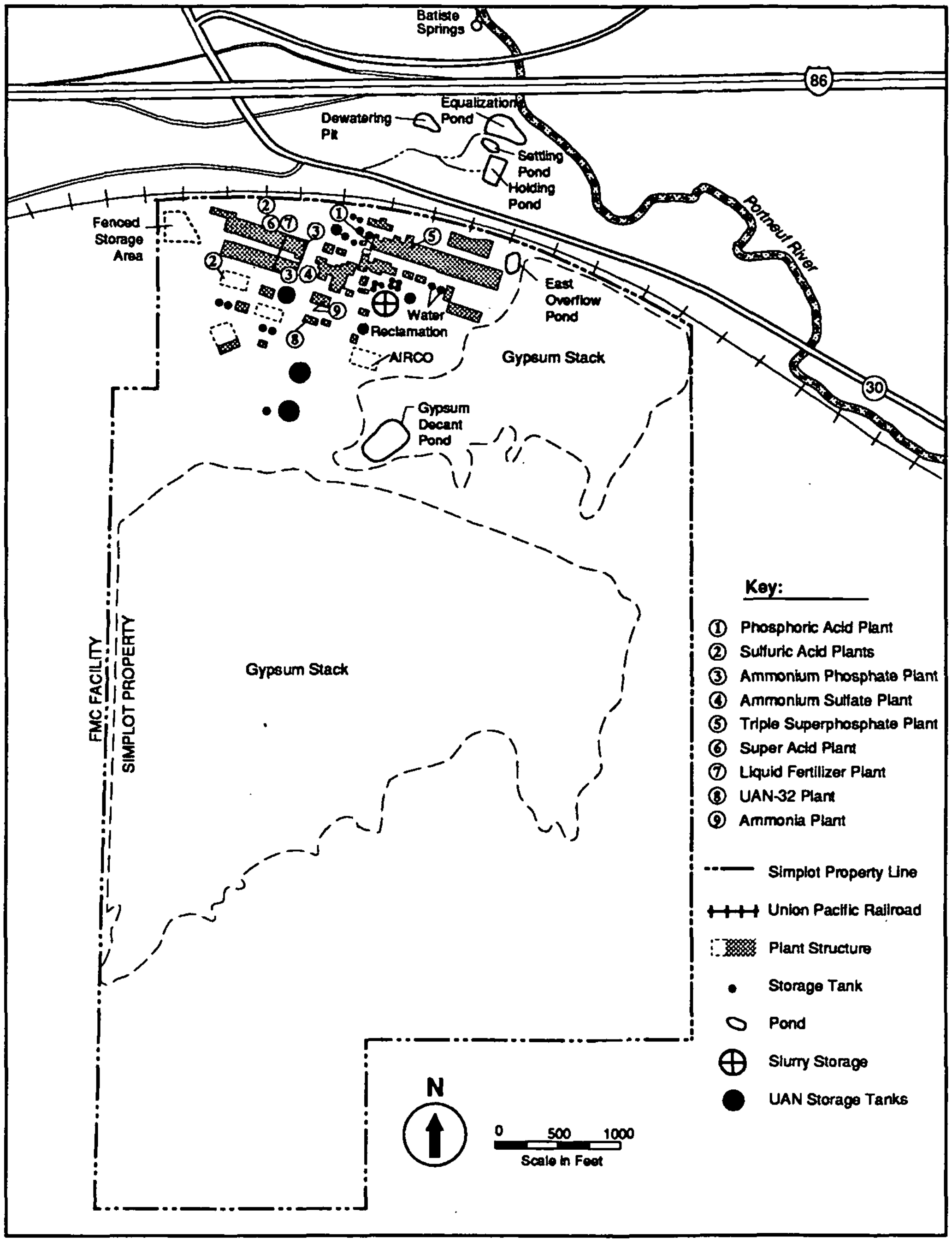


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Figure 2-3 Simplot Facility Plan

The plant is an integration of several different processing units, each unit producing either an intermediate or a final product. A block flow diagram summarizing Simplot's operational processes is provided in Figure 2-4. Summaries of each plant and its respective products are presented below.

2.2.2.1 *Phosphoric Acid Plant*

The ground ore is digested for several hours with sulfuric acid to produce phosphoric acid (26 to 30 percent P_2O_5) and a hydrated calcium sulfate byproduct (gypsum). Phosphoric acid process descriptions refer to P_2O_5 levels at each stage of production because the acid is sold according to its P_2O_5 content. The phosphoric acid/gypsum slurry is pumped to a vacuum filtration system for separation of the gypsum solids from the phosphoric acid liquid. The phosphoric acid is then used to make the various grades of fertilizers either as is or after concentration to 44 to 52 percent P_2O_5 by vacuum evaporation. The gypsum slurry is thickened to 25 to 40 percent solids to minimize water consumption and is then pumped to the gypsum stack.

2.2.2.2 *Sulfuric Acid Plant*

Simplot produces the sulfuric acid used primarily for the production of phosphoric acid. Liquid sulfur is burned with air to form SO_2 which is then reacted with oxygen over a catalyst to form SO_3. The SO_3 is absorbed in water, in the presence of 98 percent sulfuric, to form sulfuric acid, H_2SO_4.

2.2.2.3 *Ammonium Phosphate Plants*

Several grades of solid fertilizers are produced in the ammonium phosphate (ammo-phos) plants. Phosphoric acid, sulfuric acid, and ammonia are mixed in a reactor to form a slurry. The slurry is combined with recycled ammo-phos product in a granulator. The slurry coats the recycled particles forming a larger particle of ammo-phos. The granulated product is then dried and screened, with the intermediate sized particles being the final product. The oversized material is crushed and recycled with the fines.

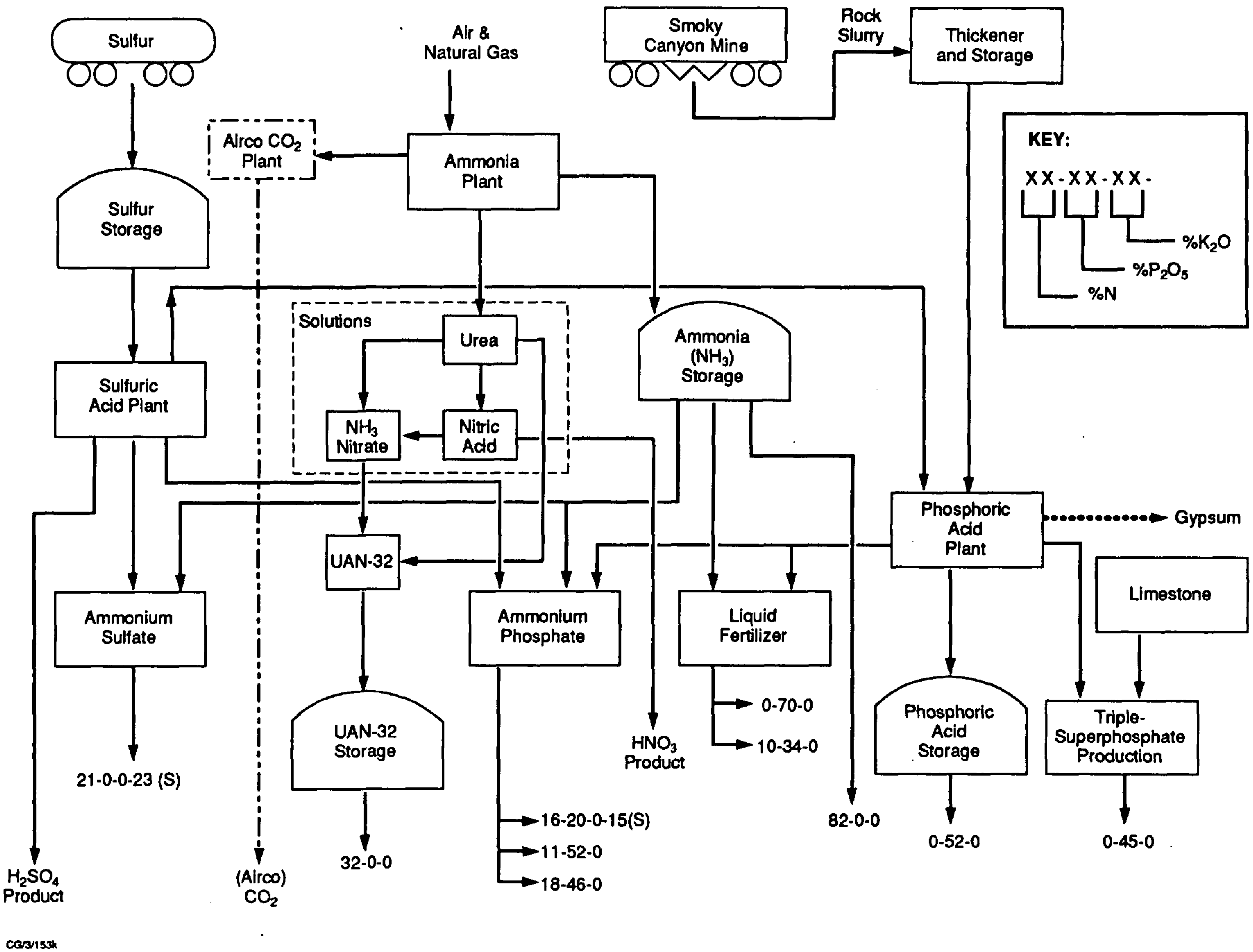

Figure 2-4 General Flow Diagram - Simplot Don Plant Flow Sheet

2.2.2.4 *Ammonium Sulfate Plant*

Ammonium sulfate is a solid fertilizer produced by the reaction of ammonia and sulfuric acid under vacuum. The vacuum crystallization reaction forms product crystals which are separated from liquid by centrifuging. The crystals are dried and stored as product, and the liquid is recycled. A major source of ammonium sulfate to the plant is an ammonium solution from the Amm SO_X scrubber on the #3 sulfuric acid plant.

2.2.2.5 *Triple Superphosphate Plant*

Triple superphosphate is a solid fertilizer currently produced by a patented process. The resulting acidulated solid is granulated, dried, and screened.

2.2.2.6 *Super Acid Plant*

Super phosphoric acid (68 percent P_2O_5) is produced by concentration of phosphoric acid through vacuum evaporation. The water vapor that is removed in the super acid plant is condensed and returned to the phosphoric acid plant for reuse.

2.2.2.7 *Liquid Fertilizer Plant*

Liquid ammo-phos is produced by reacting ammonia, water, and super phosphoric acid.

2.2.2.8 *UAN-32 Plant*

UAN-32 is a liquid solution of urea and ammonium nitrate used as a fertilizer. It is produced by combining ammonium nitrate and urea solution to produce a 32 percent nitrogen solution. The nitric acid is also produced at the facility by the conversion of ammonia into nitric oxides and subsequent solution in water. The ammonium nitrate is produced by the reaction of nitric acid and ammonia. Urea is produced by a reaction between carbon dioxide and ammonia in an autoclave.

2.2.2.9 *Ammonia Plant*

The ammonia used in plant processes is produced at the facility using natural gas, steam, and air. Steam and natural gas are passed over a catalyst at high temperature and pressure to form hydrogen and carbon monoxide. Air is mixed with this gas stream, and the carbon monoxide is subsequently converted to carbon dioxide which is absorbed in a recirculating UCARSOL solution. Unabsorbed carbon dioxide is reacted with hydrogen in a methanator forming methane and water. The major process gas stream now contains hydrogen, nitrogen, and water. The water is removed and the process gas stream is compressed and reacted over a catalyst to form ammonia. The absorbed carbon dioxide is recovered and used in the production of urea or sold to Airco.

2.3 WASTE TYPES AND MANAGEMENT UNITS - FMC FACILITY

The following description of waste types is divided into hazardous and non-hazardous wastes because FMC has applied for a RCRA Treatment, Storage, and Disposal Facility Permit and is operating under Interim Status. The permit application contains a more detailed description of the hazardous waste types and the waste management units in which they are managed (FMC, 1991a).

2.3.1 RCRA Hazardous Wastes

The various RCRA hazardous wastes generated at the FMC facility are discussed below. Block Flow diagrams for each of the RCRA hazardous wastes are provided in Appendix A.

2.3.1.1 *Water*

Some fresh or recycled process water known as Industrial Clarified Water (ICW) is used for operations such as phosphorus storage (phosphorus must be covered with water to prevent oxidation), pump packing purges, and slag quenching. As a result of its contact with phosphorus, this wastewater contains suspended and dissolved phosphorus, and other dissolved solids (known collectively as phossy wastes) and is called phossy water. The phossy water is pumped to the Phase IV ponds – 11S, 12S, 13S, and 14S – for clarification. This series of four single-lined ponds clarifies the liquid through sedimentation. The water passes through at least two ponds allowing the suspended solids to settle out. Then the clarified water is routed back to the plant to serve as makeup water for plant process use to minimize fresh water contact with phosphorus. An FMC plant water flow diagram is shown in Figure 2-5.

Solids that settle out of the water contain varying amounts of phosphorus. The phosphorus can be reclaimed through a recovery process. Phossy water as a waste stream is not considered, nor has it tested, hazardous except as a wastewater liquor in Pond 15S, which failed the toxicity characteristic leaching procedure (TCLP) test for cadmium. Based on knowledge of the waste streams, it is suspected that Pond 8S would also fail the TCLP test for cadmium. Phossy wastes, initially thought to be characteristically hazardous due to toxicity, have not proven to be so in extraction procedure (EP) toxicity and TCLP tests. The phossy wastes are chemically reactive due to their phosphorus content, but do not exhibit the reactivity characteristic as defined in 40 CFR 261.23.

2.3.1.2 *Scrubber Blowdown*

As mentioned in the description of furnace operations, Medusa scrubbers clean fumes off of the furnace tapping operations. The Andersen scrubber on the phos dock cleans the fumes off the dock operations of phosphorus loading. The Medusa scrubber system produces blowdown that exhibits the toxicity characteristic for cadmium. The Medusa scrubber blowdown is treated in the wastewater treatment unit. In the past, the phos dock scrubber blowdown failed the TCLP test for cadmium and corrosivity. Recent improvements to the phos dock have rendered this stream nonhazardous. The phos dock scrubber blowdown is sent to a sump and then out to the Phase IV ponds for clarification.

2.3.1.3 *Precipitator Dust*

Precipitator dust (furnace off-gas solids) from the furnace precipitator operations is slurried and pumped to pond 8E where the suspended solids settle out. The solids are distributed mechanically and then pumped to Pond 9E during the portion of the year that the pond is receiving slurry. Pond 9E is currently being used as a storage pond for the waste stream. The precipitator slurry fails TCLP tests for cadmium.

2.3.1.4 *Andersen Filter Media*

Andersen filter media is used in scrubbers in the furnace tapping and phosphorus loading dock fume treatment, and in the pond 8S recovery process. The used filter media was considered hazardous waste. However, a treatment unit was installed in late 1991. The treatment unit renders the media nonhazardous. FMC continues to handle the media as a hazardous waste and is shipping the media to a permitted hazardous waste facility in Utah for disposal. FMC anticipates that disposal of this material as a nonhazardous waste will begin in the near future.

Andersen filter media was a hazardous waste because it failed the TCLP test for arsenic and cadmium. The filter media is stored at the site until a full shipment can be sent to the disposal site. No long-term storage or onsite disposal of filter media is currently taking place. However, prior to removal of the Bevill exemption for these wastes, used Andersen filter media was disposed of in two separate cells of an onsite landfill.

2.3.1.5 *Andersen Filter Media Rinse Water*

The Andersen filter media treatment (washing) unit (WMU #13) generates a rinse water which fails the TCLP test for cadmium. The rinse water is routed to the Medusa tank and is also treated in the wastewater treatment unit.

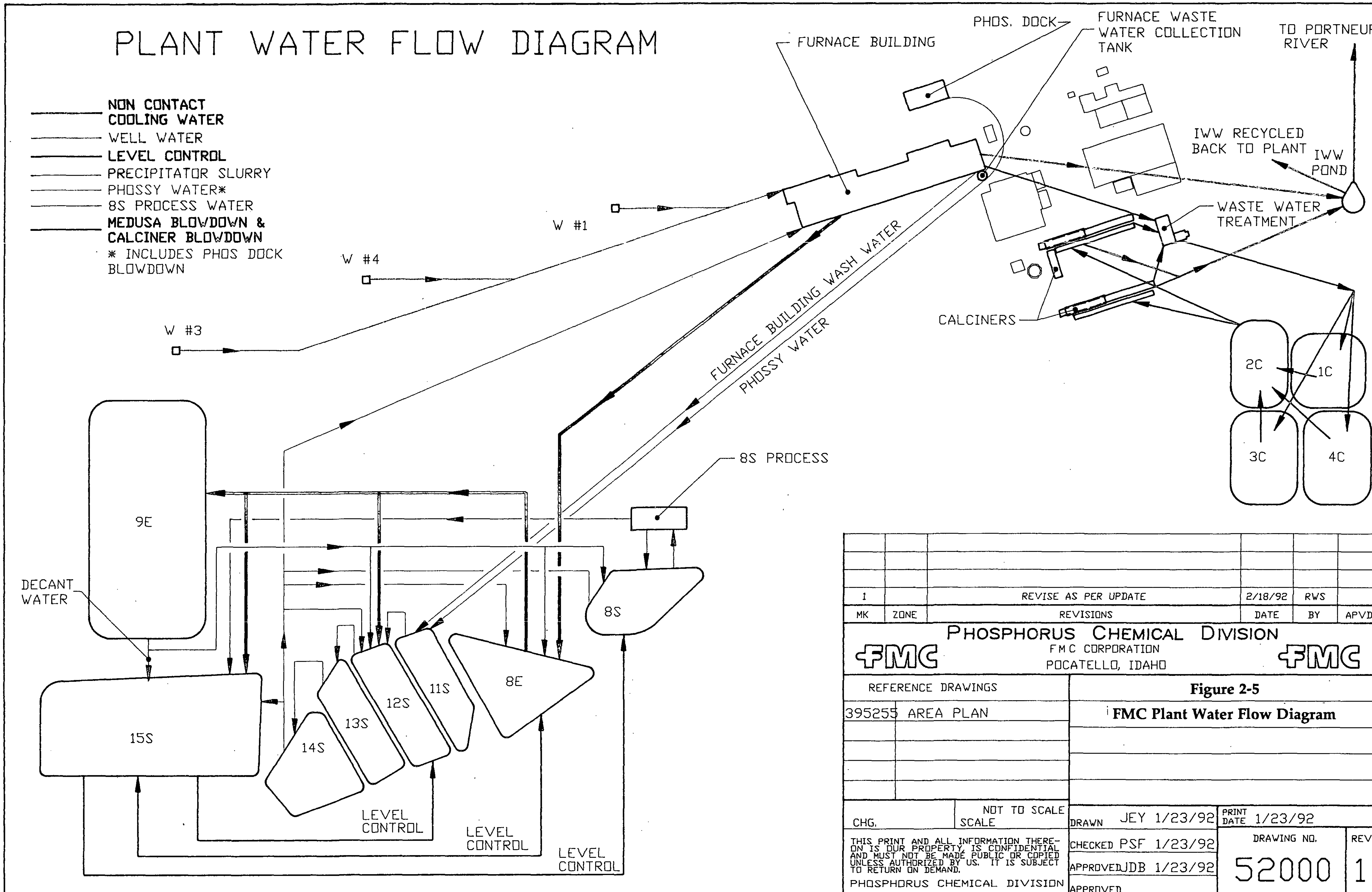

Figure 2-5

FMC Plant Water Flow Diagram

2.3.1.6 *Other Streams*

Other waste streams at the FMC facility consist of small quantities of waste paint, degreasing, and laboratory solvents. Spent solvents are collected by Safety Kleen for recycle. The remainder of these wastes are shipped off site for disposal. Occasionally, lab packs – small quantities of various waste laboratory chemicals – are also shipped off site for disposal.

2.3.2 Non-RCRA Waste Types and Byproducts

2.3.2.1 *Calciner Scrubber Blowdown*

The emissions from the calciners are controlled by two scrubbers in parallel. The calciner scrubber blowdown is collected and goes to the wastewater treatment unit where it is mixed with the Medusa scrubber blowdown and treated in the same process. The treated blowdown is clarified in the calciner ponds and recycled back to the calciner scrubbers. A block flow diagram of the Medusa scrubber blowdown is provided in Appendix A.

2.3.2.2 *Ferrophos*

Ferrophos is a byproduct of furnace operation. The ferrophos is collected in sand molds, cooled, and stored on site in various areas before being sold.

2.3.2.3 *Slag*

Slag, a byproduct of furnace operations, is stored on site in large piles. Slag is composed primarily of calcium silicate.

2.3.3 Air Emissions

Air emissions from the FMC facility are regulated by the State of Idaho. The FMC facility permit covers the shale crushing operations, the calciners, various materials handling systems, the four electric arc furnaces, the electrostatic precipitators, the carbon monoxide flare pit, and the phos dock. The sulfur content of fuel and the particulate emissions from plant roads are also regulated. Particulate matter is the major contaminant regulated by the air emission permits.

2.3.4 Waste Management Units

The FMC facility has designated certain areas as waste management units (WMUs) for ease of identification and regulation. Following are brief descriptions of the waste management units at FMC. These waste management units are summarized along with waste types in Table 2-1 and are shown in Figure 2-6. Those units with WMU numbers are hazardous waste management units as identified in the FMC Part B permit application.

2.3.4.1 Ponds 1C, 2C, 3C, and 4C

Operated since 1987, the calciner pond area consists of four double-lined surface impoundments of approximately 2 acres each that manage the treated wastewater from the calciners. Ponds 1C and 4C are settling ponds that are full and in their drying cycle. Pond 3C is a settling pond that discharges clarified water into Pond 2C, a surge pond. Water from Pond 2C is recycled to the calciners for reuse. Dimensions of the calciner ponds are as follows:

- 1C: 341 feet long, 335 feet wide, and 19 feet deep
- 2C: 401 feet long, 258 feet wide, and 30 feet deep
- 3C, 4C: 432 feet long, 302 feet wide, and 20 feet deep

2.3.4.2 Old Settling Ponds

Old phossy wastes storage ponds (1S, 2S, 3S, 4S, 5S, 6S, and 7S), now inactive and covered, held phossy water, phossy wastes, and/or precipitator slurry. These ponds were not engineered, and therefore, no design drawings or dimensions exist.

Table 2-1
FMC FACILITY WASTE TYPES AND WASTE MANAGEMENT UNITS

AREA	RCRA REGULATORY CONSIDERATIONS	UNDERLYING WASTE MANAGEMENT UNIT	WASTE TYPES
Pond 9E (Active)	RCRA WMU #9	—	Precipitator slurry
Pond 15S (Active)	RCRA WMU #3	Ponds 5E, 6E (Inactive)	Process wastes, etc.
Pond 8E (Active)	RCRA WMU #11	Pond 2E (Inactive)	Precipitator slurry
		Pond 1E (Inactive)	
Ponds 11S, 12S, 13S, 14S (Active)	RCRA WMU #8	Pond 3E (Inactive)	Phossy solids
Pond 8S and	RCRA WMU #7	—	Phossy material
8S Recovery Unit	RCRA WMU #4	—	Phossy material
Slag Pit/Collection Sump	RCRA WMU #5	—	Slag pit wastewater
Pond 10S (Inactive)		—	Precipitator dust
Ponds 1S, 2S, 3S (Inactive)		—	Phossy solids
Ponds 4S, 5S, 6S, 7S (Inactive)			
Slag Pile		—	
Ponds 1C, 2C, 3C, 4C (Active)		Old Ponds 1C and 2C (Inactive)	Solids in calciner scrubber water
Old Landfill (Inactive)		—	Unknown
Landfill (Active)			
Portion 1 (Inactive)		—	
Portion 2		—	Andersen filter media
Portion 3		—	Office trash
			Empty drums
Ponds 1E, 4E (Inactive)		—	Precipitator slurry
Area 9S (Inactive)		Pond 9S (Inactive)	Precipitator dust
Waste Oil Storage Area		Pond 2S (Inactive)	Lube oils and transformer oils (<50 ppm PCBs)
Drum Storage Area	RCRA WMU #1	—	Spent solvents
Chemical Lab Seepage Pit		—	Laboratory chemicals
Railroad Swale		—	Onsite runoff
IWW Basin/IWW Ditch		—	Non-contact IWW
PCB Storage Shed		—	PCBs
Transformer Salvage Area		—	PCBs
Bannock Paving		—	
Kiln Scrubber Ponds			
Ponds (Inactive)		—	Kiln scrubber blowdown
Overflow Pond (Inactive)		—	Kiln scrubber blowdown
Andersen Filter Media Wash Station	RCRA WMU #13	—	Andersen filter media wash water
Septic Tank Drainfields			Sanitary

Table 2-1 (Cont'd)

AREA	RCRA REGULATORY CONSIDERATIONS	UNDERLYING WASTE MANAGEMENT UNIT	WASTE TYPES
Waste Piles South of Calciner Ponds		Old Calciner Ponds	Wastewater treatment fines
Waste Pipeline Cleanout Areas			Phossy material and precipitator slurry
Boiler Fuel Tank Area			Fuel oil

Notes: IWW = Industrial Wastewater, WMU = Waste Management Unit

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FMC Waste Management Units

2.3.4.3 *Pond 8E*

The dust that comes off the electrostatic precipitators is slurried and pumped to Pond 8E (WMU #11). The pond is a 2.8-acre surface impoundment that is double-lined with 30 mil polyvinyl chloride and holds approximately 27 acre-feet of precipitator slurry with suspended solids. In the pond, the suspended solids settle out, are distributed mechanically throughout the pond, and are dredged periodically to Pond 9E. Pond 8E, which was constructed in 1984, is double-lined and equipped with a leachate detection and collection system.

2.3.4.4 *Pond 9E*

Pond 9E (WMU #9) is used for storing the precipitator slurry that is dredged from Pond 8E. The 12.9-acre pond is double-lined and equipped with a leachate collection system. It holds 73 acre-feet of water and dredged solids from Pond 8E. Since sale of precipitator fines stopped in 1990, they will be held in this pond until final disposition has been determined.

2.3.4.5 *Area 9S*

The storage pile for dried precipitator dust covers approximately 3.0 acres and is contained within an unlined, excavated area to minimize wind erosion. It was constructed in 1971 without a liner. The pile is below grade and inspected weekly. The area was not used on or after July 23, 1990.

2.3.4.6 *Pond 10S (Dry)*

A 1.7-acre single-lined pond (10S) managed precipitator slurry from the fluidized bed dryer which is no longer in use. The pond is dry and inactive, and contains dried precipitator dust.

2.3.4.7 *Furnace Operation Byproducts*

Slag, a byproduct of furnace operations, is stored on site in large piles. Slag piles are located south of the plant operations areas.

The ferrophos piles are located in several specific places on the facility and consist of cast pieces of ferrophos, a byproduct of furnace operations. The piles have no designed structure.

2.3.4.8 *Ponds 11S, 12S, 13S, and 14S*

The four phossy water clarifier ponds (also called the Phase IV ponds) (WMU #8) are positioned in series so that water can pass through at least two in succession. Ponds 11S, 12S, and 13S are each approximately 2 acres in area and 20 acre-feet in volume. Pond 14S is about 3 acres in area and 33 acre-feet in volume. The ponds, constructed in 1980, are single-lined with 30 mil polyvinyl chloride. Ponds 11S, 12S, and 13S receive phossy water from various plant operations and from Pond 15S for level control. The phossy water carries phossy wastes in the form of suspended phosphorus and other solids. The solids and phosphorus settle out in the ponds and are dredged to Pond 15S. Water passes through the ponds by gravity separation, and the clarified water from Pond 14S is recycled back for use in the plant. In addition to receiving phossy water, Pond 13S receives some phosphorus-contaminated solids.

2.3.4.9 *Pond 8S*

Pond 8S (WMU #7) is an unlined pond containing phossy waste from previous operations. Phossy waste has not been sent to Pond 8S since 1981. The pond covers 3.2 acres and contains approximately 70 acre-feet of phossy waste containing dirt, water, and elemental phosphorus. Water in Ponds 15S and 8S can be transferred to and from either pond for level control. The pond is inspected daily for general condition and adequate water freeboard level. The material in this pond is pumped out and treated in the Pond 8S recovery process (WMU #4).

2.3.4.10 *Pond 15S*

Pond 15S (WMU#3) covers an area of 9.4 acres and holds 140 acre-feet of liquid and phossy wastes. The pond is double-lined with 30 mil polyvinyl chloride and includes a leachate detection system. It receives phossy waste from dredged ponds and process operations, decant water from precipitator slurry Pond 9E, and wastewater liquor from the Pond 8S recovery process. In addition to the leak detection system, there are four leak detection wells around the unit. Freeboard is inspected and measured daily, and the unit is inspected weekly.

2.3.4.11 *Industrial Wastewater (IWW) (Cooling) Basin*

The cooling basin is used for cooling non-contact industrial wastewater from the calciner and furnaces. The basin is 131 feet by 102 feet and 4 feet 6 inches deep. Wastewater is cooled and discharged to the Portneuf River (National Pollutant Discharge Elimination System [NPDES] Permit #ID-000022-1). The permit regulates the amount of heat that can be discharged to the river.

2.3.4.12 *IWW Ditch*

The IWW ditch carries industrial wastewater from the cooling basin. The ditch drains to a culvert which exits the facility from the northeast corner of the property, and eventually discharges into the Portneuf River. It is approximately 1,700 feet long and averages about 6 feet in width. Approximately 1 foot of water is contained in the ditch, which has a total depth of approximately 3 feet.

2.3.4.13 *Kiln Scrubber and Overflow Ponds*

Three kiln scrubber ponds, located under the current #2 calciner, held kiln scrubber blowdown in the past. These ponds were excavated and the wastes removed before the calciner was constructed in 1966. In addition, an old pond collected overflow from the kiln scrubber ponds. It was located under the current silica storage pile.

2.3.4.14 *Old Evaporation Ponds*

Seven old evaporation ponds (1E, 2E, 3E, 4E, 5E, 6E, and 7E), now dry, held precipitator slurry/dust and/or phossy wastes. Ponds 2E, 3E, 5E, and 6E were partially removed during the construction of the Phase IV ponds and Pond 15S. Active units are now operating where the four ponds were located. (See Figure 2-1.)

Ponds 1E, 4E, and 7E have also been removed from service. These ponds were not engineered, therefore, no design drawings or dimensions exist.

2.3.4.15 *Railroad Swale*

A ditch, approximately 12 feet wide, running along the length of the railroad tracks on the north edge of the facility, is used to catch stormwater run-off. The railroad swale does not discharge to surface water. The swale was not engineered, so it has no specific dimensions, structure, or drawing.

2.3.4.16 *Slag Pile*

Slag, a byproduct of furnace operations, is stored on site in large piles. Slag piles are located south of the plant operations areas.

2.3.4.17 *Landfill*

For the past decade, the facility has operated a solid waste landfill on the south end of the facility for trash and debris, including asbestos, from all plant operations and areas. Operations have included the disposal of used Andersen filter media in two separate disposal cells. Andersen filter media was disposed of on site before the effective date of its regulation as hazardous waste, and the cell containing this waste has been closed and covered since March 1, 1990. The asbestos wastes were handled and disposed of according to applicable regulations.

2.3.4.18 *Old Landfill*

Previously, a solid waste landfill was operated on site by FMC. This landfill was removed from service and covered. The old landfill at the FMC facility was closed in 1980 when the new landfill was constructed. There are no known records of when the old landfill was first used. The old landfill received various wastes from numerous plant activities. Little documentation is available regarding the types, volume, or containers of hazardous substances placed in the old landfill, and testing for hazardous constituents was not done on materials sent to the old landfill. FMC personnel have indicated that the following hazardous materials or substances (based on process knowledge) may have been placed in the old landfill - asbestos wastes, spent solvent, oily residuals, transformer oil, kiln scrubber solids, phosphorus-bearing wastes, fluid bed dryer wastes, and Andersen filter media.

2.3.4.19 *Chemical Lab Seepage Pit*

Prior to 1980, inorganic and organic chemical waste from the lab was disposed of in the chemical laboratory seepage pit located beneath the main parking lot. Buried drain lines carried chemical waste to a covered pit by way of an isolated drainage system. The seepage pit is currently used by the laboratory for disposal of wastewater.

2.3.4.20 *Drum Storage Area*

The drum storage area (WMU #1) is an area approximately 11 feet by 15 feet located south of the technical support building. It is constructed of a concrete slab on grade with protective side curbing, and is designed to store 26 55-gallon drums (1,430 gallons) of waste liquid solvents which are listed as hazardous wastes. The waste solvents are of three types: laboratory solvents, which may be a mixture of toluene, xylene, benzene, and contaminated with elemental phosphorus; paint solvents, which may be a mixture of xylene, toluene, and methyl ethyl ketone; and degreasing solvents, which may be a mixture of methylene chloride, 1,1,1-trichloroethane, and contaminated with dirt, oil, and water. The unit is inspected weekly.

2.3.4.21 *Waste Oil Storage Area*

A drum storage area now overlies old Pond 2S. The dimensions of the area are approximately 20 feet by 100 feet. Various heavy lube oils, sludges, and transformer oil containing less than 50 parts per million (ppm) polychlorinated biphenyls (PCBs) are stored in 55-gallon drums in this area. A concrete pad and dike were constructed for the waste oil storage area in November 1990.

2.3.4.22 *PCB Storage Shed*

The PCB storage shed is used to store drums of transformer oil with concentrations of PCBs greater than 50 ppm. The shed is also used to store PCB capacitors. The shed walls and foundation are concrete.

2.3.4.23 *Transformer Salvage Area*

The transformer salvage area, located near inactive Pond 1S, is a storage area for used transformers. Any residual oils remaining in these transformers contain PCB concentrations less than 50 ppm. The transformers have been removed and the area cleaned and graded.

2.3.4.24 *Bannock Paving Company Land*

Bannock Paving Company leases land from FMC in the north-central portion of the FMC property. Until June 1990, Bannock purchased slag from FMC for use in its paving operations. The slag is stored in various piles throughout the leased area. FMC has not sold any slag since June 1990.

2.3.4.25 *Slag Pit and Slag Pit Wastewater Collection Sump*

The slag pit wastewater collection sump (WMU #5) is a small area (approximately 10 feet by 10 feet) located in the southeast corner of the slag pit. The sump collected phossy water and pumped it to the Phase IV ponds. In March 1991, the sump was replaced by the furnace washdown collection tank. FMC is in the process of developing a closure plan to be submitted as required under RCRA.

2.3.4.26 *Old Calciner Ponds*

The old calciner ponds were in approximately the same location as new Calciner Ponds 3C and 4C. These ponds were excavated when the new ponds were constructed. The sediments and excavated soils were removed and placed in the area south of the ponds where calciner fines and sediments from the current ponds are also being placed. The old ponds were not engineered; therefore, no design drawings exist and actual dimensions are not known.

2.3.4.27 *Boiler Fuel Tank and Pipeline*

The boiler fuel tank and pipeline contained fuel oil for operating the boilers. The tank had an approximate capacity of 20,000 gallons. The fuel tank was located north of the phos dock in a diked area with a compacted soil base. The fuel oil was pumped via pipeline from the tank to the boilers. Petroleum hydrocarbon leaks from piping have occurred historically in this area.

2.3.4.28 *Septic Tank Areas*

The FMC plant uses septic tanks and drainfields for disposal of sanitary sewage. Until 1991, the main change house and the administration building were served by two large drainfields. In 1991, the change house was connected to the Pocatello publicly owned treatment works (POTW) and the change house sanitary wastes are now discharged directly to the POTW. There are an additional seven drain fields for the mobile shop, the furnace building, the burden business building, the briquetting building, the water treatment building, the kiln building, and the crusher control building.

2.3.4.29 *Calciner Pond Sediment Area*

FMC recently removed the treated calciner sludge from Pond 1C. The sediment was placed on land south of the calciner fines area and allowed to dry. The material was very gelatinous and took several months to dry.

2.3.4.30 *Calciner Fines Area*

FMC removed the calciner sludge and soil from the old calciner ponds prior to construction of the new calciner ponds. The excavated material was placed on land south of the calciner pond area and allowed to dry.

2.3.4.31 *Secondary Condenser/Fluid Bed Drier Area*

The secondary condenser is used to remove elemental phosphorus from the furnace exhaust gases. It is in the same location as the former fluid bed drier unit. The fluidized bed drier was used in the early 1980s to dry and oxidize precipitator slurry to remove elemental phosphorus so that the precipitator dust could be sold for recycling.

2.3.4.32 *8S Recovery Process*

The 8S recovery process (WMU #4) was built in 1983 to recover elemental phosphorus from Pond 8S. The process unit was built and operated as a test facility. Because of climatic conditions, it was operated primarily during the summer months. The processing equipment is located on a concrete pad with a dike.

2.3.4.33 *Phossy Waste Pipeline Cleanout Areas*

The phossy waste and phossy water are pumped from the furnace washdown collection tank and the phos dock via pipelines to the Phase IV ponds. Because of the high solids content and the physical state of the elemental phosphorus, cleanout taps are provided along the pipeline at locations where solids may tend to accumulate, such as where the pipeline bends or changes direction.

2.3.4.34 *Precipitator Slurry Pipeline Cleanout Areas*

Precipitator slurry is pumped from the furnace building via pipelines to Pond 8E. Because of the high solids content and the physical state of the elemental phosphorus, cleanout taps are provided along the pipeline at locations where solids may tend to accumulate, such as where the pipeline bends or changes direction.

2.3.4.35 *Old Ponds 00S and 0S*

What little is known about these ponds was obtained from retired FMC personnel. The ponds were not engineered so drawings and specifications are not available. The ponds have not been identified on old aerial photos so exact locations and approximate dimensions are not available.

These ponds were reportedly built in 1954 or 1955 to receive precipitator dust and phossy residuals. Pond 00S is located under the mobile shop which was built in 1965. There was no cover material used. Pond 0S was a pit only, not a "pond." It is now located in a mobile equipment parking lot. The pit was covered with slag prior to 1965.

2.3.4.36 *Miscellaneous Potential Sources*

Intermittent spills, process areas, roads, and rail car loading and unloading areas are discussed in Section 6.1 as potential sources.

2.4 WASTE TYPES AND DISPOSAL UNITS - SIMPLOT FACILITY

The following description of the Simplot waste types does not include a discussion of hazardous versus nonhazardous wastes because the wastes are not subject to RCRA regulations.

2.4.1 Waste Types

The main wastes produced at the Simplot facility are the gypsum solids and liquids generated in phosphoric acid production. Other wastes produced at the site include waste oils and various solvents. The Simplot facility also treats non-contact water in a series of three water treatment ponds. The treated water is nutrient rich and is sold for irrigation and fertilization values.

2.4.1.1 *Gypsum Solids and Liquids*

The gypsum produced from the phosphoric acid process is slurried (25 to 40 percent solids) and pumped to the top of the gypsum stack. A series of perforated high density polyethylene (HDPE) pipes located beneath the gypsum stacks collect some of the water used to slurry the gypsum and deliver it to the lined decant pond. The solids settle out of the water in this pond, and the water is subsequently recycled for further use in plant processes. Due to process changes, the gypsum slurry now contains carbonaceous material previously removed by calciners. The carbonaceous material in the incoming ore is similar to lignite coal. The resulting residues in the gypsum stream are suspected to be partially oxidized carbonaceous materials and char.

The gypsum decant pond, located north of the present gypsum stack, was constructed in 1972. The pond is approximately 300 feet long by 200 feet wide and is single-lined with "Griffolyn" Type 65 black reinforced plastic. It receives gypsum liquid collected from beneath the gypsum stack through PVC pipes. The water is recycled to the plant process water reclaim system after solids settling.

The east overflow pond is an unlined surface impoundment approximately 0.8 acres in size. It is located east of the plant operational areas. This pond receives surface water run-off as well as excess process water from the plant water reclaim system in the event of a power failure or other process upset. Reclaim system water includes gypsum filter wash water, scrubber water, and cooling tower water. Any water collected in this pond is pumped back to the reclaim water system or the gypsum decant pond for later reuse. The east overflow pond also has an emergency discharge system which discharges water to the water treatment ponds via gravity flow through an underground pipeline.

2.4.1.2 *Waste Oils and Solvents*

Waste oils are separated from water in a waste oil separator prior to collection in a waste oil storage tank. These waste oils are collected for recycle on a weekly basis by Cowboy Oil. Spent solvents are collected by Safety Kleen for recycle.

2.4.1.3 *Non-Contact Water and Laboratory Wastes*

A series of three lined ponds, located north of the plant between Highway 30 and the Portneuf River, is used to treat non-contact water including boiler and cooling tower blowdown, compressor coolant water, demineralizer regeneration water, laboratory wastes (i.e., acids, ammonia, and sodium hydroxide), and storm water. No contact process waters enter these ponds; all contact waters stay within the reclaim system. The non-contact water is collected by a facility drainage system and flows through a pipe under Highway 30, enters an open unlined ditch, and flows into a plastic-lined holding pond or an equalization pond if the pH of the water is within the range of 4.6 to 8.6.

Water in the holding pond is pH adjusted with soda ash before being pumped to a concrete-lined settling pond for clarification. After the suspended solids have settled out of the water, the treated water flows to the equalization pond where it is combined with the water that did not require pH adjustment. The equalization pond is constructed of compacted soil to which a chemical sealant has been added. Equalization pond water is pumped to a large surge pond for storage prior to being used for irrigation and fertilization. From time to time, sediments have been dredged from the ponds and transferred to an unlined dewatering pit adjacent to the ponds.

The treated water is nutrient rich and has been sold for irrigation/fertilization since July 1980 under a joint land application permit with the City of Pocatello. EPA funded the Joint Waste Treatment Feasibility Study, Project No. EPA P0000080-03, which evaluated effluent handling alternatives available to the City of Pocatello STP and local industries. The study evaluated the suitability of wastewaters for irrigation including characteristics of nutrient level, salinity, organic loading, sodium absorption ratio, and trace elements. The trace elements evaluated included aluminum, arsenic, boron, cadmium, chromium, cobalt, copper fluoride, iron, lead, manganese, nickel, selenium, and zinc. The recommendations from the study in Report No. 219 included: "The EPA and the State Division of Environment should, where possible, assist and encourage the City of Pocatello and J. R. Simplot Company toward the completion of the land application project. Implemented by: Idaho Department of Health and Welfare and EPA." The recommendation was given force by an EPA Consent Order in 1978.

Under an Order on Consent, Simplot chose to eliminate discharges to the Portneuf River by land application of the nutrient-rich water. Prior to July 1980, the treated water was discharged to the Portneuf River. The State of Idaho has developed a Land Application permit system. As previously stated, a permit has been issued to Simplot and the City of Pocatello for operation of part of the system. A draft permit has been prepared for the Simplot portion of the system which includes requirements for groundwater monitoring.

Analytical data for Simplot's irrigation water have been compared to EPA's land application limits for wastewater. The comparison is presented in Table 2-2. The concentrations of the various inorganic compounds analyzed are considerably below the EPA recommended concentration limits.

The surge pond in which the treated water is intially stored is located across Highway 30. When storage requirements exceed the capacity of the surge pond, water is transferred to a larger impoundment located on the Hale property several miles from the facility. Both storage units are constructed of compacted soil to which a chemical sealant has been added. The units are located as shown in Figure 2-7. Simplot's water and water from the Fort Hall Canal and Portneuf River is used to irrigate the Swanson, Carlson, and Bannock Paving properties. A mixture of Simplot and Fort Hall Canal water is used for irrigation of the Spanbauer property and has been used for irrigation of the DeKay property. A mixture of Simplot water and effluent from the City of Pocatello sewage treatment plant is used to irrigate the Whitewater Development , Hale, and Mountain View Farms properties. All of these properties are shown in Figure 2-7.

2.4.1.4 *Air Emissions*

Air emissions from the Simplot facility are regulated by a State of Idaho Air Permit (#1260-0060). The permit covers gaseous and/or particulate emissions from ore handling activities, individual process plants, and reclaim cooling towers. In response to a Notice of Violation from the State of Idaho, Simplot modified plant operations (Section 2.2.2) to substantially reduce particulate matter emissions by approximately 72 percent. Included in this plant modification was the elimination of calciner units and exposed raw ore handling facilities. Elimination of calciner units reduced total plant carbon monoxide and oxides of nitrogen emissions. Elimination of the exposed raw ore handling facilities greatly reduced not only the total particulate matter emissions, but fluoride and radionuclide emissions as well. The plant operational changes were completed in September 1991.

Table 2-2

EPA WASTEWATER GUIDELINES [a] VERSUS SIMPLOT IRRIGATION WATER DATA [b]

Recommended and estimated maximum concentrations of specific ions in irrigation waters [c] (mg/l)

Element	3 ft/yr Application Recommended Limit [d]	Simplot Irrigation Water
Aluminum	20.0	0.319
Arsenic	2.0	0.003
Beryllium	0.50	<0.001
Boron	2.0-10.0	0.264
Cadmium	0.050	0.006
Chromium	1.0	0.426
Cobalt	5.0	0.002
Copper	5.0	0.017
Fluoride	15.0	5.122
Iron	20.0	0.580
Lead	10.0	0.007
Lithium	2.5[e]	0.099
Manganese	10.0	0.037
Mercury	-	<0.001
Molybdenum	0.050[f]	0.008
Nickel	2.0	0.050
Selenium	0.020	<0.001
Silver	-	<0.001
Zinc	10.0	0.500

Notes:

(a) Land Treatment of Municipal Wastewater Effluents, Design Factors II. EPA, 1976.

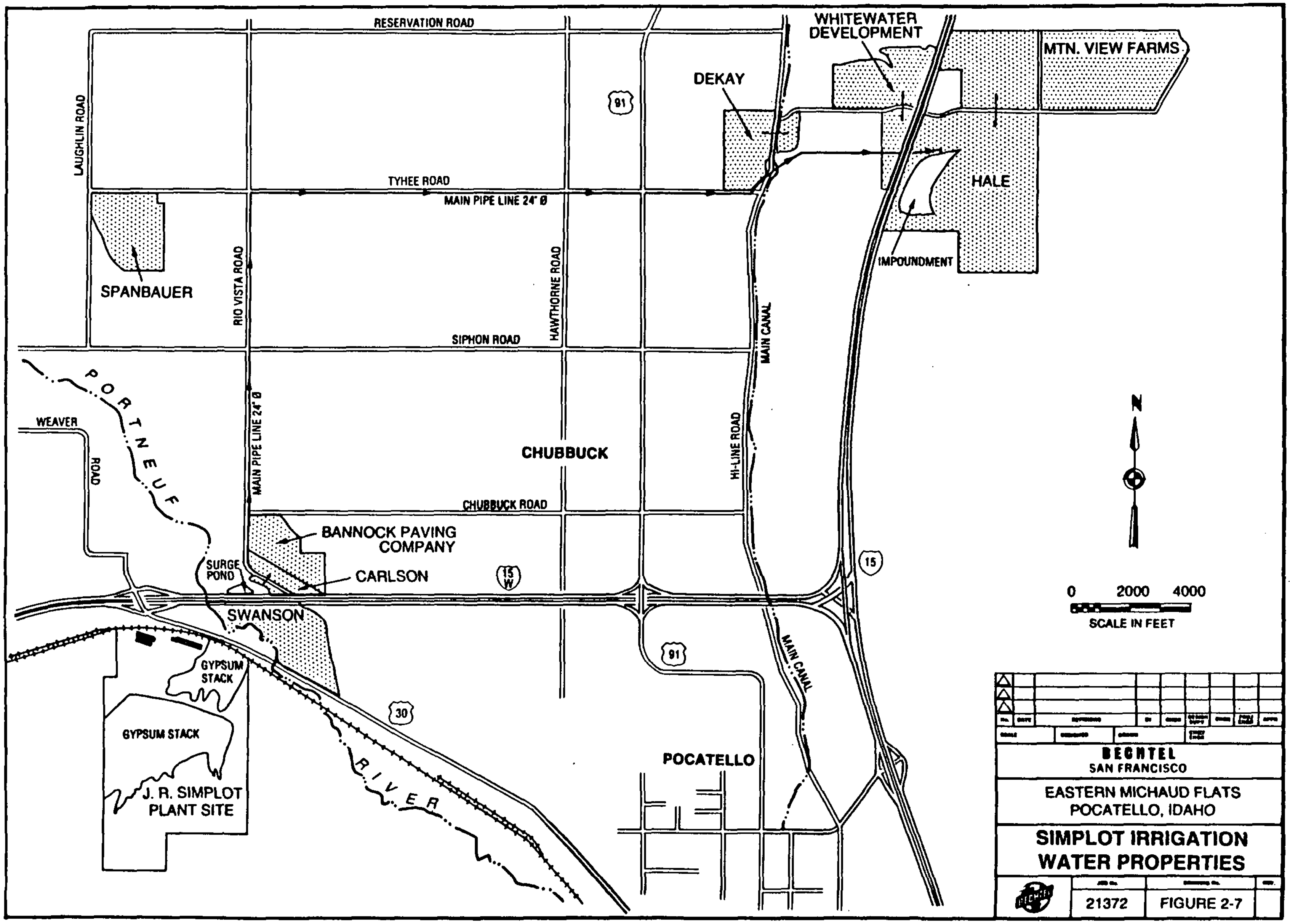
(b) J. R. Simplot Company Surge Pond - water analyses from 06/08/81 to 08/01/91.

(c) These levels will normally not adversely affect plants or soils. No data are available for mercury, silver, tin, titanium, or tungsten.

(d) EPA Water Quality Criteria, 1972. For waters used up to 20 years on fine textured soils of pH 6.0 to 8.5.

(e) Recommended maximum concentration for irrigating citrus is 0.075 mg/l.

(f) For only acid fine textured soils or acid soils with relatively high iron oxide contents.


RESERVATION ROAD
WHITEWATER DEVELOPMENT
MTN. VIEW FARMS
DEKAY
91
LAUGHLIN ROAD
TYHEE ROAD
MAIN PIPE LINE 24" Ø
HALE
IMPOUNDMENT
SPANBAUER
RIO VISTA ROAD
HAWTHORNE ROAD
SIPHON ROAD
MAIN CANAL
PORTNEUF
WEAVER
ROAD
MAIN PIPE LINE 24" Ø
HI-LINE ROAD
CHUBBUCK
N
CHUBBUCK ROAD
BANNOCK PAVING COMPANY
SURGE POND
CARLSON
15 W
15
0 2000 4000
SCALE IN FEET
SWANSON
91
MAIN CANAL
GYPSUM STACK
GYPSUM STACK
30
RIVER
POCATELLO
J. R. SIMPLOT PLANT SITE
BECHTEL
SAN FRANCISCO
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
SIMPLOT IRRIGATION WATER PROPERTIES
21372
FIGURE 2-7

2.4.2 Waste Disposal Units

As mentioned in Section 2.2.1, there are currently two gypsum stacks located at the facility. In addition, a solid waste landfill and a trash landfill are also used at the facility. A brief summary of each of these units, including the types of wastes contained, is presented below.

2.4.2.1 *Gypsum Stacks*

There are two gypsum stacks located on the facility grounds south of the plant operating areas. The original gypsum stack is the northernmost of the two stacks and continues to be used intermittently. The southernmost stack has been in use since 1966.

2.4.2.2 *Landfills*

A solid waste landfill is located just east of the gypsum decant pond between the gypsum stacks. It lies partly on native soil and partly on the northernmost gypsum stack. The initial date of operation of this landfill is unknown. Construction wastes, demolition rubbish, and neutralized solid wastes from spills are all disposed of in the solid waste landfill.

Simplot used to dispose of general office waste and garbage from the lunchroom in two trash landfills. The more recently used of the two is located above the southernmost gypsum stack; the older of the two is to the northwest of the more recently used. Simplot now sends trash offsite.

3. Site Background and Setting

Section 3

Site Background and Setting

This section describes the regional environmental setting of the EMF site in terms of geology, groundwater hydrology, surface water hydrology, climate, air quality, surface soil types, and ecology as well as what is currently known about site-specific stratigraphy and hydrogeology. This section also provides a summary of previous site investigations conducted at the EMF site. The descriptions of the site background and setting are based on a review of existing data and interviews with plant personnel at the FMC and Simplot facilities. This knowledge will be substantially augmented by scheduled investigations and studies described in this Work Plan. The results will be incorporated in the Preliminary Site Characterization Report and the Draft Remedial Investigations Report.

3.1 REGIONAL ENVIRONMENTAL SETTING

The EMF site is located on the southern margin of the Eastern Michaud Flats at the base of the northernmost mountains of the Bannock Range (see Figure 3-1). The Michaud Flats are part of the extensive Snake River Plain. Elevations range from 4400 feet along the Portneuf River to 5800 feet at the mountain summit.

The Portneuf River, a major tributary of the Snake River drainage system, is the only perennial stream in the immediate vicinity of the EMF site (see Figure 3-1). The river flows northwesterly through Pocatello and discharges into the American Falls Reservoir. Prior to construction of the American Falls Dam in the 1920s, the confluence of the Portneuf and Snake rivers was approximately 10 miles west of where the Portneuf River now empties into the reservoir (Trimble, 1976). In the vicinity of the EMF site, the river is believed to be recharged by groundwater.

Groundwater beneath the EMF site is believed to be recharged by percolation of local precipitation and storm run-off through unconsolidated deposits and bedrock. Shallow groundwater in the vicinity of the EMF site is used primarily for irrigation and industry (Jacobson, 1982).

Industrial operations in the vicinity of the FMC and Simplot facilities which may also have an impact on the local environment include the Pacific Hide and Fur and

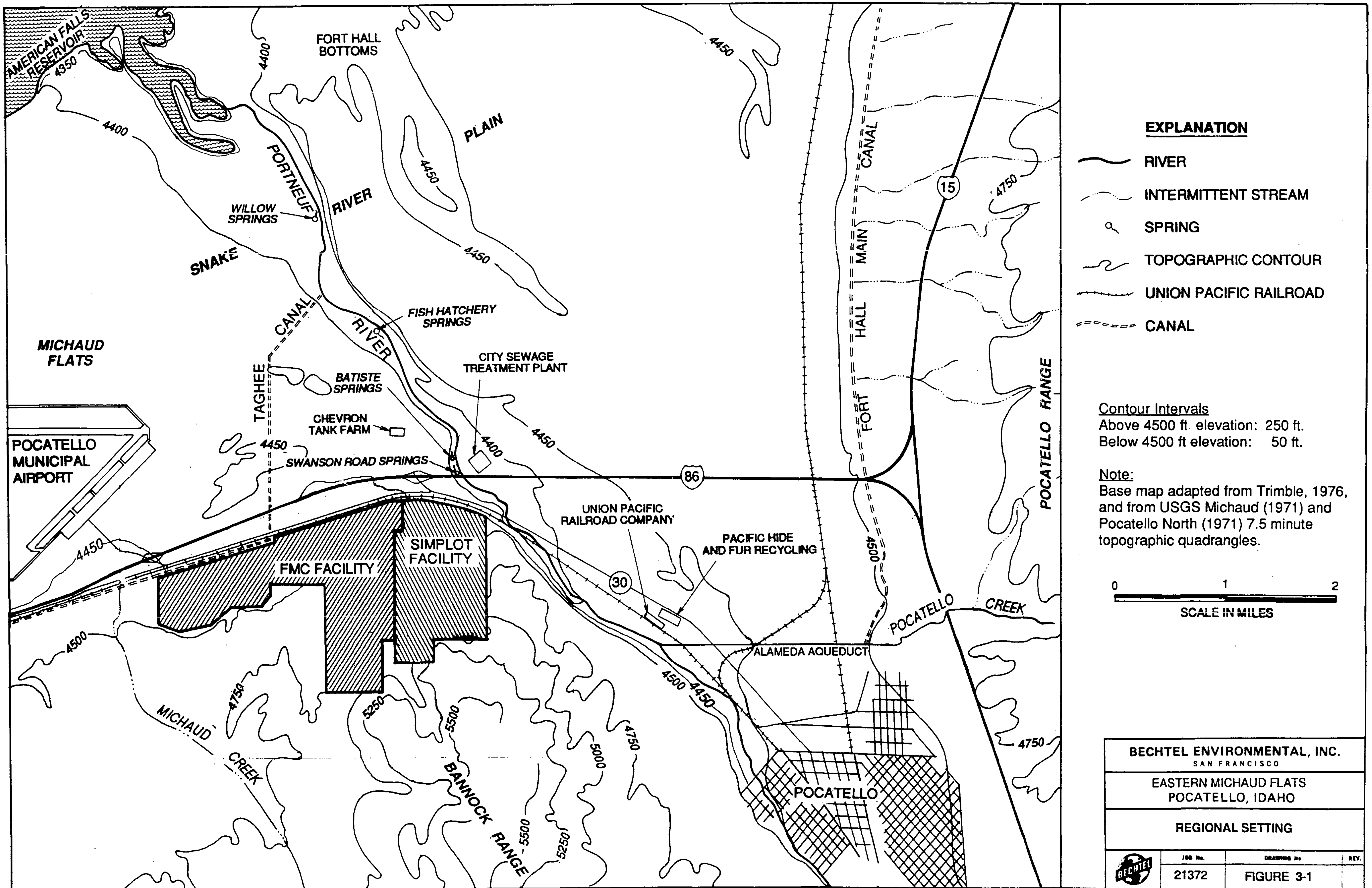
Union Pacific Railroad Co. NPL sites located upriver of the EMF site between Highway 30 and the railroad; the Chevron tank farm off Weaver Road to the north of the FMC and Simplot facilities; and the City of Pocatello sewage treatment plant, northeast of the facilities and adjacent to the Portneuf River. Pacific Hide and Fur and Union Pacific Railroad Co. NPL sites are located approximately 1 mile and 3/4 mile respectively from the easternmost border of the two facilities. The Chevron tank farm lies approximately 3/4 mile north of the two facilities. The City of Pocatello Sewage Treatment plant is less than 1/2 mile north of the easternmost border of the two facilities. Locations of these operations are indicated on Figure 3-1.

These industrial operations are located up and downstream of the EMF facilities along the Portneuf River and may have or have had an impact on sediment and surface water quality in the river. Other activities which may have or have had an impact on the river include a fertilizer operation north of the FMC facility, stormwater runoff from the City of Pocatello, and sewage from residences not tied into the City of Pocatello sewage treatment system.

Investigations of the Pacific Hide and Fur NPL site, a scrap metal collection facility, have revealed soil contaminated with PCBs and lead. Local media have reported solvent contamination associated with a sludge pit at the Union Pacific Railroad Co. site. The city sewage treatment plant applies sludge to farmlands to the north of the FMC and Simplot facilities including parts of the Pocatello airport. The sewage treatment plant also discharges treated water to the Portneuf River. If problems associated with these or other activities in the vicinity of the EMF site appear to be related or commingled with problems originating at the FMC and/or Simplot facilities, the interrelationships will be explored in the course of the EMF site RI.

3.1.1 Geology

The Eastern Michaud Flats site lies on the boundary of two major physiographic provinces, the southeastern margin of the Snake River Plain section of the Columbia Plateau province and the northernmost mountain of the Bannock Range



BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

REGIONAL SETTING

JOB No.	DRAWING No.	REV.
21372	FIGURE 3-1	

in the Basin and Range province. These two provinces contrast greatly in physical aspect and geologic history. The Snake River Plain is a slight structural depression within the Columbia Plateau that has been characterized by episodic volcanism and sedimentary deposition. The Basin and Range province, including the Bannock Range, has been actively faulted and folded, resulting in the formation of rugged, steep, northwesterly-trending mountain ranges and intervening valleys.

The regional geology of the southeastern margin at the Snake River Plain and the northern mountains of the Bannock Range are described in this section in terms of their stratigraphy and structure. A regional geologic map is presented in Figure 3-2. It should be noted that the term Eastern Michaud Flats, as used in this discussion, refers to the physiographic area and is not synonymous with "EMF site."

3.1.1.1 Snake River Plain Stratigraphy

The Snake River Plain is underlain at depth by a basement complex composed of partially metamorphosed marine sedimentary and volcanic rocks, ranging in age from Pre-Cambrian to Cambrian (Trimble, 1976). Unconformably overlying the basement complex are siliceous volcanics (primarily rhyolite) of Tertiary age. Late Tertiary (Pliocene) to Holocene basalt flows intrude and overlie the rhyolite. Unconsolidated deposits of fluvial, colluvial, lacustrine, and aeolian origin overlie and are interbedded with the basalt flows. A stratigraphic column for this region of the Snake River Plain is presented in Figure 3-3.

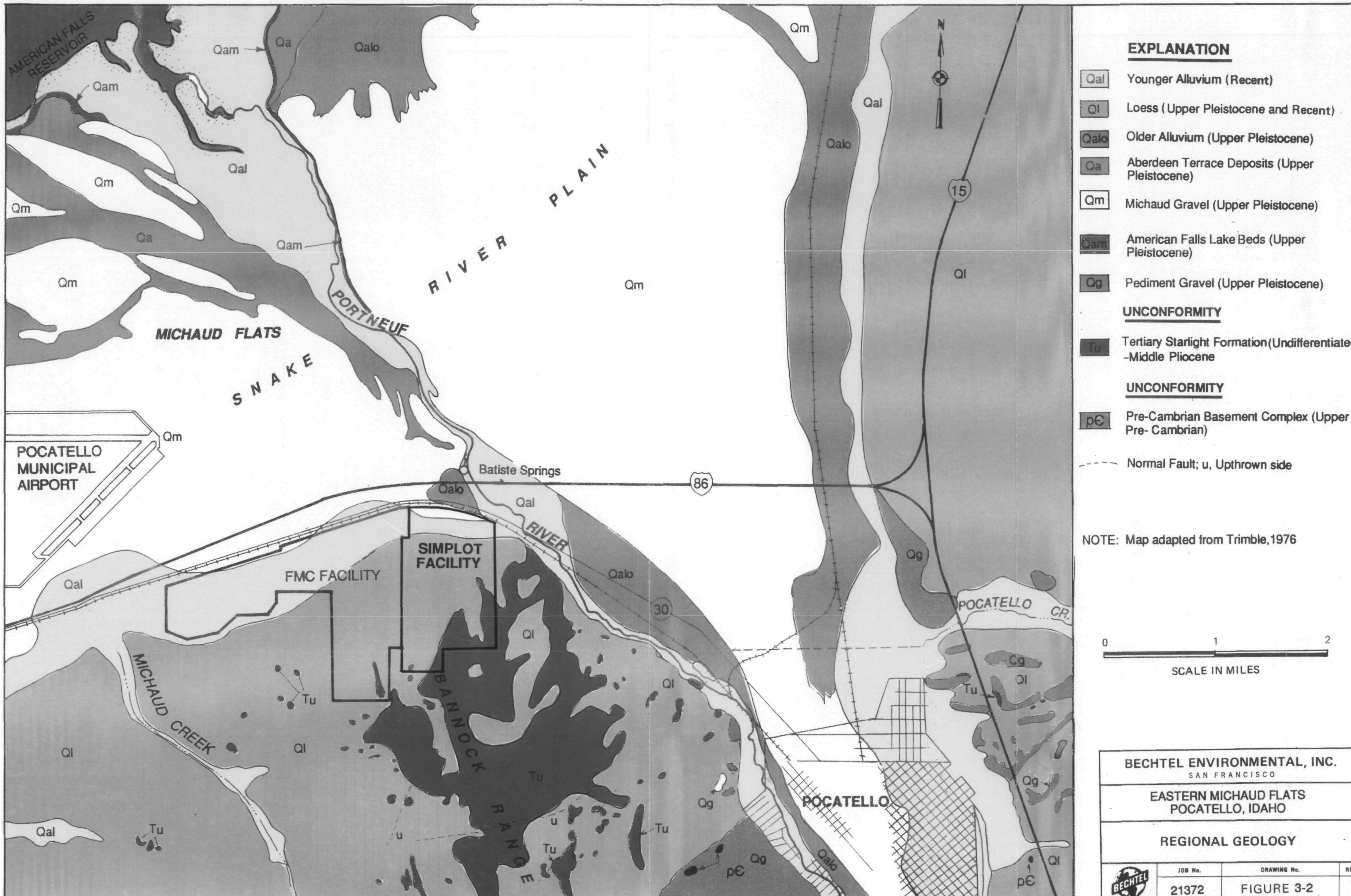
Extensive outcrops of the Pre-Cambrian and Cambrian rocks comprising the basement complex occur more than four miles south of the EMF site in the Bannock Range. Basement complex rocks are also exposed in the Pocatello and Portneuf ranges east of the Portneuf River (Link et al., 1985). Pre-Cambrian metavolcanic and metasedimentary rocks of the Pocatello Formation, the oldest rocks mapped in the region, have been exposed by the downcutting action of the Portneuf River through the western flank of an anticline in the Pocatello Range (Ludlum, 1943; Trimble, 1976). The dominant lithologies of rock units comprising the basement complex are quartzite, limestone, and unmetamorphosed to slightly metamorphosed, fine- to coarse-grained sediments (Trimble, 1976).

Rhyolite tuffs of the Starlight Formation directly overlie the basement complex. The regional unconformity (see Figure 3-3) between the basement complex and the Starlight Formation suggests that post-Cambrian to Middle Tertiary (Miocene) rocks are absent in the Eastern Michaud Flats area.

Basalt flows of Pleistocene age overlie the Starlight Formation on portions of the Snake River Plain. Eruptions from more than 300 volcanic vents in the Late Pleistocene produced the sequence of flows (Stearns et al., 1938). Individual basalt flows in the sequence are believed to differ in lateral extent and relative age. Differentiation of individual flows is difficult due to burial by successive flows and/or alluvium.

Late Pleistocene basalt flows have been encountered in borings drilled in the EMF area (Jacobson, 1982). The lateral extent, stratigraphic relationships, and lithologic characteristics of these flows are presently poorly defined, but appear to correlate with those of the Big Hole Basalt that crops out west of the American Falls Reservoir (Trimble, 1976). Well borings drilled in the Portneuf River Valley have encountered younger basalt flows. The two basalt flows overlie approximately 30 feet of unconsolidated alluvium deposited by the ancestral Portneuf River. The younger flow terminates approximately one mile downstream of Pocatello; the older flow is believed to have terminated further downstream (Stearns et al., 1938). The base of the older basalt flow in Portneuf Valley has been dated as approximately 32,500 years old (Trimble, 1976).

The Sunbeam Formation overlies the basalt flows in the Eastern Michaud Flats area (Jacobson, 1982). Where the basalt and pediment gravels are absent, the unbedded to poorly bedded, unconsolidated deposits of the Sunbeam Formation may directly overlie the rhyolitic tuffs of the Starlight Formation. The Sunbeam Formation is composed of alluvial and colluvial deposits of silt with lenticular deposits of sand



AMERICAN FALLS RESERVOIR
Qam
Qa
Qalo
Qm
Qal
MICHAUD FLATS
SNAKE RIVER PLAIN
PORTNEUF
POCATELLO MUNICIPAL AIRPORT
Batiste Springs
86
15
30
RIVER
SIMPLOT FACILITY
FMC FACILITY
MICHAUD CREEK
BANNOCK RANGE
POCATELLO CR.
POCATELLO
Ql
Tu
Qg
pЄ
u
N
EXPLANATION
Qal Younger Alluvium (Recent)
Ql Loess (Upper Pleistocene and Recent)
Qalo Older Alluvium (Upper Pleistocene)
Qa Aberdeen Terrace Deposits (Upper Pleistocene)
Qm Michaud Gravel (Upper Pleistocene)
Qam American Falls Lake Beds (Upper Pleistocene)
Qg Pediment Gravel (Upper Pleistocene)
UNCONFORMITY
Tu Tertiary Starlight Formation (Undifferentiated) -Middle Pliocene
UNCONFORMITY
pЄ Pre-Cambrian Basement Complex (Upper Pre- Cambrian)
Normal Fault; u, Upthrown side
NOTE: Map adapted from Trimble, 1976
0
1
2
SCALE IN MILES
BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
REGIONAL GEOLOGY
BECHTEL
JOB No.
21372
DRAWING No.
FIGURE 3-2
REV.

QUATERNARY	Holocene	Qa	YOUNGER ALLUVIUM - sand, silt, gravel and clay with overlying and interbedded windblown deposits (loess); generally reworked older alluvium
		Qalo	OLDER ALLUVIUM - sand, silt, gravel, and clay, with overlying and interbedded loess of variable thickness
	Late Pleistocene	Qa	ABERDEEN TERRACE DEPOSITS - pebble gravel approximately 10 feet thick; generally reworked Michaud Gravel
		Qm	MICHAUD GRAVEL - Debris flow deposits composed of sand, gravel, and large boulders (1 - 8 feet in diameter); unit is 50-80 feet thick
		Qam	AMERICAN FALLS LAKE BEDS - fine-grained deposits mainly comprised of clay with minor amounts of sandy silt and pockets of fine sand
		Qsu	SUNBEAM FORMATION - unbedded silt with lenticular fine sand and gravel of alluvial and colluvial origin with interbedded loess
		Qbh	BIG HOLE BASALT - dense, blue-gray basalt; basalt may be 170 feet thick locally
		Qg	PEDIMENT GRAVELS - mostly large, angular to rounded quartzite boulders to pebble gravels derived from mountain fronts
			? UNCONFORMITY ?
Tertiary-Quaternary	Late Pliocene to Early Pleistocene	Qtr	RHYOLITE - light gray to pink, flow-banded, vesicular rock with 15-25% phenocrysts of feldspar, quartz, and biotite; approximately 200 feet thick; overlain by Quaternary loess
			UNCONFORMITY
TERTIARY	Middle Pliocene	Tu	STARLIGHT FORMATION (undifferentiated) - primarily bedded rhyolite tuff with at least two interbedded basalt flows; locally overlain by trachyandesite and related intrusive rocks; commonly stained with iron oxide; may have marl and claystone beds and gravel conglomerate near base; locally at least 800 ft. thick
			UNCONFORMITY
Pre-Tertiary		pЄu-Єu	BASEMENT COMPLEX (undifferentiated) - mostly metamorphosed pre-Cambrian to Cambrian volcanic and sedimentary rocks

Note: Formation descriptions are based on the work of Ludlum (1943), Trimble (1976), and Jacobson (1982).

Figure 3-3 Generalized Regional Stratigraphy of the Southeastern Snake River Plain

and gravel, including angular to rounded cobbles and boulders. The abundant tan, calcareous silt in the formation is probably eroded loess; the sands and gravels appear to be of fluvial and colluvial origin. The Sunbeam Formation is not exposed in the vicinity of the EMF site.

Late Pleistocene basalt flows deposited on the Snake River Plain displaced the ancestral Snake River a few miles south of its present position. These basalt flows dammed the Snake River during the Late Pleistocene, forming a lake about 40 miles long and 12 miles wide (Stearns et al., 1938). The resulting lacustrine deposits comprise the American Falls Lake Beds, poorly consolidated beds of clay and silt, with occasional pockets of fine-grained sand and gravel. The American Falls Lake Beds includes a basalt member that occurs approximately 100 feet below the top of the lake beds. The shoreline of the ancestral lake attained a maximum elevation of 4450 feet before the ancestral basalt dam was breached and the lake drained. The American Falls Lake Beds crops out near the mouth of the Portneuf River.

A Late Pleistocene catastrophic flood deposited large-diameter boulders of the Michaud Gravel over the American Falls Lake Beds. Floodwaters emanating from the ancestral Lake Bonneville, which occupied most of northern Utah, deposited the Michaud Gravel by overtopping a drainage divide in the Portneuf River drainage system. The floodwaters eroded basalts and alluvium in the Portneuf River Valley and continued to flow out onto the Eastern Michaud Flats, forming a large alluvial fan. The Michaud Gravel includes boulders of quartzite and basalt that exceed 8 feet in diameter.

Pebble gravels known as the Aberdeen Terrace deposits (Trimble, 1976) have been mapped in the distributary channels that dissect the alluvial fan formed by the Michaud Gravel. The channel deposits probably represent reworked materials of the Michaud Gravel.

Older alluvial deposits crop out adjacent to the present Portneuf River channel north of Pocatello (Trimble, 1976). The older alluvium consists of poorly-sorted to well-sorted, fine- to coarse-grained materials. Loess is interbedded with the stream deposits. Younger alluvium of Holocene age occurs in the distributary channels of the Portneuf River and is composed of reworked older alluvium. The younger alluvium also occurs as the fine-grained deposits of intermittent streams tributary to the Snake River. On the western slopes of the Pocatello Range, north of Pocatello, the younger alluvium consists of eroded loess deposits.

3.1.1.2 *Bannock Range Stratigraphy*

The Starlight Formation underlies the foothills immediately south of the Eastern Michaud Flats, where it is mantled with Quaternary deposits of wind-blown silt (loess). Trimble (1976) characterized the formation as having three members: (1) a lower member that is composed primarily of rhyolitic tuff and contains a minimum of two interbedded basalt flows, marl, and claystone, (2) a rhyolitic ash flow tuff unit known as the tuff of the Arbon Valley, and (3) an upper member composed of bedded rhyolitic tuff and an overlying trachyandesite flow. Figure 3-2 shows that the Starlight Formation (Tu) crops out on top of the mountain immediately south of the Eastern Michaud Flats (directly south of the FMC facility). As mapped by Trimble (1976), the trachyandesite flow of the upper member is the dominant exposed lithology. Bedded rhyolitic tuffs of the lower member are mantled with loess. A younger rhyolitic unit of Late Pliocene to Early Pleistocene age intrudes and/or overlies the Starlight Formation (Trimble, 1976). Outcrops of the younger rhyolite, described in the regional stratigraphic column (Figure 3-3), are of limited areal extent. For the purposes of this study, the younger rhyolite has been grouped with the rhyolites of the undifferentiated Starlight Formation (Tu) on the regional geologic map (Figure 3-2).

Erosion of mountain fronts of the Bannock and Pocatello ranges during the Early to Middle Pleistocene resulted in the deposition of the pediment gravels. Large, angular blocks to pebble-sized gravels derived from the basement complex overlie eroded surfaces of both the Starlight Formation and the basement complex on mountain slopes. Gravel, composed of rhyolite fragments which can be cemented by caliche (calcium carbonate), overlies the Starlight Formation at lower elevations.

3.1.1.3 *Snake River Plain and Bannock Range Structure*

The boundary between the Columbia Plateau and Basin and Range physiographic provinces at the southeastern margin of the Snake River Plain coincides with a major tectonic boundary. While the Snake River Plain has been a zone of relative tectonic quiescence since the onset of the Late Pleistocene (Trimble, 1976), the Bannock, Pocatello, and Portneuf ranges of southeastern Idaho were formed by extensive folding and faulting that began in the Early Paleozoic and recurred periodically through the onset of the Pleistocene Epoch (Ludlum, 1943; Trimble, 1976).

The Snake River Plain is underlain by a broad structural depression. Subsidence of the Snake River Plain has been linked to prolific volcanism that occurred from the Late Pliocene through the Early Pleistocene (Stearns et al., 1938). The extrusion of rhyolitic tuffs and basalt on the Snake River Plain is believed to have removed crustal support for the land surface, resulting in recurring widespread subsidence. Unconsolidated deposits of Quaternary age overlying the basalts on the Snake River Plain are not deformed by faulting or folding (Trimble, 1976).

Pre-Cambrian and Cambrian rocks of the basement complex underlying the Bannock, Pocatello, and Portneuf ranges of the Basin and Range province were extensively folded prior to the Late Mesozoic. The Cambrian-age quartzites underlying the northernmost portion of the Bannock Range dip approximately 30 degrees to the northeast, forming the left flank of a broad syncline that extends eastward under the Portneuf River Valley (Trimble, 1976). The syncline adjoins an anticline to the east that underlies Chink's Peak in the Pocatello Range.

Thrust faulting occurred in southeastern Idaho approximately 65 to 150 million years ago during the Mesozoic (Link et al., 1985). The Bannock, Pocatello, and Portneuf ranges lie within a klippe, an erosional remnant of an extensive thrust plate. The thrust plate truncated the basement complex rocks. The klippe is bounded on the west by a thrust fault underlying the Deep Creek Mountains to the west and the Putnam Thrust Fault in the Pocatello Mountains to the northeast (Trimble, 1976).

Movement along normal fault planes produced the northwesterly-trending mountain blocks and intervening valleys characteristic of the Basin and Range province in the late Miocene or early Pliocene time. The faults occurred prior to the eruption of the rhyolitic tuffs of the Starlight Formation and are buried by them. Two younger normal faults transect the Starlight Formation in the Bannock Range (Trimble, 1976). The faults occur approximately three miles south of the Snake River Plain. The northeasterly-trending Trail Creek Fault was mapped by Trimble (1976) approximately two to five miles southwest of Pocatello in the Bannock Range. A Plio-Pleistocene fault exposed as a scarp in the Bannock Range about five miles south of the Snake River Plain was mapped by Greensfelder (1976). No faults of Holocene age are known to have been mapped in the Basin and Range province in the vicinity of Pocatello.

3.1.2 Groundwater Hydrology

Groundwater underlying the Eastern Michaud Flats portion of the Snake River Plain is used extensively for irrigation and industry. Because it is an economically important resource for the area, the groundwater underlying the Eastern Michaud Flats has been studied during several investigations, including those by the USGS (West and Kilburn, 1963; Jacobson, 1982 and 1984) and others (Goldstein, 1981; Geraghty and Miller, 1982a and 1982b).

The primary water-bearing formations underlying the Eastern Michaud Flats include the Tertiary Starlight Formation and the pediment gravels, Big Hole Basalt, and the Sunbeam Formation of Late Pleistocene age (Jacobson, 1982). (There is some question whether the Big Hole Basalt is a primary water-bearing formation [FMC 1991b].) These units underlie the unconsolidated clays of the American Falls Lake Beds. The clay confines the groundwater under artesian conditions. Jacobson (1984) grouped these units together as the "deep aquifer" system in which most irrigation and industrial wells in the Eastern Michaud Flats are completed.

The Michaud Gravel, Aberdeen Terrace deposits, and Quaternary alluvium that crop out at the ground surface in the Eastern Michaud Flats also contain groundwater. These units overlie the American Falls Lake Beds and contain groundwater under unconfined (water-table) conditions (Jacobson, 1982). Domestic water wells in the area are typically completed in this "shallow" aquifer. According to Jacobson (1982), groundwater resources within the Eastern Michaud Flats are primarily utilized for irrigation and industry. Assuming annual groundwater pumping rates being constant, 44,700 acre-feet per year is withdrawn for irrigation and 7200 acre-feet per year is withdrawn for industrial use (Jacobson, 1982). Seepage losses to the Portneuf River were estimated to be 309,000 acre-feet per year (Jacobson, 1982).

3.1.2.1 Occurrence and Movement of Groundwater

Groundwater underlying the Eastern Michaud Flats is recharged by percolation of storm run-off that flows in intermittent stream channels down the northernmost slopes of the Bannock Range and the western slopes of the Pocatello Range. The water-bearing units are also recharged by precipitation or irrigation return water that directly infiltrates into the Michaud Gravel and Aberdeen Terrace deposits cropping out at the ground surface.

Groundwater of the deep, artesian system is stored and transported in (1) fractured rhyolite and interstratified basalt members of the Starlight Formation, (2) the intergranular pore space of the pediment gravels, (3) the fractures, bedding planes, vesicles, and cavities characteristic of the Big Hole Basalt, and (4) the intergranular pore spaces of the poorly sorted, unconsolidated deposits of the Sunbeam Formation.

According to Jacobson (1982), wells screened in the rhyolite, basalt, or pediment gravels of the "deep" aquifer yield groundwater in the range of 500 to 2000 gallons per minute (gpm). Due to the poorly sorted nature of the Sunbeam Formation, well yields from the unit are highly variable, ranging from a few gallons per minute when completed in silt to several hundred gallons per minute when screened in lenticular sand or gravel units (Jacobson, 1982).

In the Spring of 1981, the general direction of groundwater flow in the "deep" aquifer beneath most of the Eastern Michaud Flats area was described as north-to-northwest, but near the Portneuf River, the groundwater flow direction was northeasterly (Jacobson, 1982). Hydraulic gradients in the area are very flat, ranging from one to five feet per mile.

3.1.2.2 *Groundwater Quality*

Water-quality data available from previous investigations of the Eastern Michaud Flats (West and Kilburn, 1963; Goldstein, 1981; Jacobson 1982, 1984, and 1989) are limited, but indicate that the general composition of the underlying groundwater is that of a calcium-sodium bicarbonate water.

As previously stated, the groundwater resources underlying the Eastern Michaud Flats are extensively used for irrigation. The infiltration of water can greatly influence the chemistry of groundwater underlying the area. Evaporation of irrigation water may result in the concentration of salts in surficial soils.

During 1972 and 1973, the Idaho Department of Health and Welfare conducted a groundwater monitoring study of the Michaud Flats. Elevated levels of arsenic were detected in the Old Pilot House Well located between Highway 30 and Interstate 86, north of the two facilities (see Figure 3-4). According to Goldstein (1981), arsenic concentrations in the Old Pilot House Well exceeded the U.S. Public Health Service recommended limit of 0.01 mg/l. (The primary maximum contaminant level [MCL] for arsenic in drinking water is 0.05 mg/l.) This well was installed to a depth of 113 feet and screened between a depth of 81 to 103 feet. The well was perforated in the Michaud Gravels, above the American Falls Lake beds, and was open to the "shallow" aquifer beneath Eastern Michaud Flats as later described by Jacobson (1982). Use of this drinking water well was discontinued in 1976. A replacement well (New Pilot House Well) was installed nearby to a depth of 200 feet in the "deep" aquifer (Figure 3-4). Analytical results from successive sampling rounds indicate no elevated levels of arsenic in groundwater collected from this well.

In 1977, the United States Geologic Survey (USGS) prepared an Environmental Impact Statement (EIS) to address the development of phosphate resources in southeast Idaho. The EIS attributed relatively high levels of phosphate (0.35 to 7.5 parts per million), detected in samples from Batiste Springs, to discharges to the Portneuf River from the FMC and Simplot phosphate ore processing facilities (Ecology & Environment, 1988).

From 1980 through 1989, the USGS conducted groundwater monitoring studies to assess water quality in the Eastern Michaud Flats area (Jacobson, 1982, 1984, 1989). The USGS reported that several wells drawing water from the shallow unit of the groundwater system contain elevated levels of arsenic. The groundwater samples collected from the deeper unit indicated no elevated levels of inorganics. USGS collected water quality data from selected wells and springs from December 1982 to July 1987. Water samples were collected from five wells (Michaud 1, Lindley House, Old Pilot House, New Pilot House, and Idaho Power) and one spring (Batiste). Arsenic concentrations from all sampling sites ranged from 0.003 to 0.094 mg/l. One sample from Batiste Spring and five samples from the Old Pilot House Well exceeded the primary maximum contaminant level (MCL) for drinking water (40 CFR Part 141) of 0.05 mg/l. Dissolved gross alpha concentrations ranged from 0.0011 to 0.049 mg/l as natural uranium and dissolved gross beta concentrations ranged from 4.0 to 190 pCi/l as cesium-137 (Jacobson, 1989).

Analytical data for 13 wells and seven springs in the Eastern Michaud Flats were presented by Goldstein (1981). Average concentrations of total dissolved solids (TDS), chloride, and sulfate detected in the Lindley and Crockett domestic wells, open to the "deep" aquifer, and in Batiste and Willow Springs, discharge points for groundwater in the "shallow" aquifer, exceeded average levels detected in the other 11 wells and five springs tested. There is some confusion over Goldstein's designation of Willow Springs. The USGS locates Willow Springs approximately one mile east of the Tindahay Springs while Goldstein located it approximately three quarters of a mile south of Tindahay Springs.

The Lindley and Crockett wells are shown on Figure 3-4. The Lindley Well is located approximately 300 feet north of the FMC facility. The Crockett Well was located approximately 6000 feet northwest of the Lindley Well, but was plugged and abandoned in July 1978 when its associated residence was moved to another location (Goldstein, 1981). Batiste Springs and Willow Springs are located northeast and north of the facilities, respectively, as shown in Figure 3-1. Batiste Springs is located adjacent to the Portneuf River, less than a mile northeast of the facility. Willow Springs is located approximately 2.5 miles northwest of Batiste Springs.

Samples were collected from six of the 13 wells and the seven springs studied by Goldstein beginning in November 1977 and ending in November 1978. The samples were analyzed for arsenic, barium, cadmium, lead, manganese, mercury, and zinc. Goldstein (1981) stated that high concentrations of arsenic and cadmium were found in Batiste, Willow, and Swanson Road Springs (see Figure 3-1) and in the Old Pilot House and Lindley wells. Goldstein also stated that concentrations were not consistent throughout the sampling period. Goldstein reported the following average values for arsenic and cadmium in the Batiste, Willow, and Swanson Road springs:

Spring	Arsenic mg/l	Cadmium mg/l
Batiste	0.0137	0.0026
Swanson Road	<0.0113	<0.0022
Willow	0.0278	0.0018

Goldstein also reported the following gross alpha and gross beta levels for Batiste, Willow, and Swanson Road springs:

Spring	Gross Alpha pCi/l	Gross Beta pCi/l
Batiste	5.72	23.0
Swanson Road	7.24	6.8
Willow	19.60	65.9

3.1.3 Surface Water Hydrology

The primary surface water feature in the vicinity of the EMF site is the Portneuf River. The Portneuf River is located near the northeastern boundary of the Simplot facility and about 0.5 mile to the northeast of the FMC facility (see Figure 3-1). The Portneuf River, a major tributary of the Snake River, flows from its headwaters in the Pocatello Range through Pocatello and discharges into the American Falls Reservoir.

The Portneuf River is a perennial stream with an average annual discharge of approximately 252 cubic feet per second (cfs), as calculated for a 51-year period of record (USGS, 1990). The discharge of the Portneuf River is recorded at USGS gauging station No. 13075500 located on the river at an elevation of 4430 feet. The drainage area upstream of the gauging station is approximately 1250 square miles.

The Portneuf River is a major tributary of the Snake River drainage system. Snake River discharge upstream of the American Falls Reservoir is gauged at USGS gauging station No. 13069500 in Blackfoot, Idaho, approximately 45 miles northeast of the FMC site. The average annual discharge calculated for the Snake River, upstream of the American Falls Reservoir at Blackfoot, is 4054 cfs (USGS, 1976). Snake River discharge downstream of the American Falls Reservoir has been regulated by a dam since its completion in late 1926.

Numerous springs occur adjacent to the Portneuf River channel on the Snake River Plain and include Batiste (formerly Batise) Springs and Fish Hatchery Springs (see Figure 3-1). Batiste Springs has historically been used for drinking water by as many as 1400 employees of the Union Pacific Railroad and 30 residences within the Pocatello city limits (Ecology & Environment, 1988). Union Pacific Railroad still draws water from Batiste Springs, some of which is used for drinking water. Batiste Springs, which discharges at a rate of 20 to 30 cfs (Jacobson, 1982) is located less than a mile north of the EMF site; Fish Hatchery Springs is approximately 1.75 miles north of the EMF site. The State of Idaho has historically sampled the Portneuf River and Batiste Springs.

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EMF Site Topography And Existing Well Locations

3.1.4 Climate

The EMF site is located on the border of the Upper Snake River Plains and Eastern Highlands climatic regions in southeastern Idaho (NOAA, 1982). Storms originating over the Pacific Ocean are, to a large extent, the primary sources of precipitation in Idaho. Exceptions occur in the summer, when high levels of moisture-laden air brought in from the Gulf of Mexico and Caribbean region produce thundershowers. The area is particularly susceptible to flash floods in small streams and gulches, which occur a few times each year as the result of the thundershowers.

Maritime air borne eastward on the prevailing westerly winds influences Idaho's climate. The effect of the maritime air is most noticeable in the winter, characterized by greater average cloudiness, greater frequency of precipitation, and mean temperatures above those at locations of the same altitude and latitude in the midcontinent area (Ruffner, 1978).

Unlike the climate of northern and western Idaho, the climate of eastern Idaho is characterized by a greater range between winter and summer temperatures and a reversal of the wet winter-dry summer pattern. The annual average percentage of possible sunshine is about 70 percent, and drops to 40 percent during the cloudy months of winter.

The highest temperature recorded at the Pocatello airport was 104°F in August 1969. The lowest temperature recorded at Pocatello airport was -33°F in February 1985. The warmest temperatures occur during the summer months, June through August (daily mean maximum temperature of 84.1°F), along with the least amount of precipitation (3.13 inches for the three-month period). The coldest temperatures occur during the winter months, December through February, (daily mean minimum temperature of 17.8°F) along with the greatest amount of snowfall (24.8 inches for the 3-month period). The greatest amount of precipitation (3.30 inches for a 3-month period) occurs during the spring, March through May.

The maximum monthly precipitation (water equivalent) recorded at the Pocatello airport was 3.98 inches in August 1968. The minimum monthly precipitation (water equivalent) recorded at the Pocatello airport was zero inches in October 1952 and September 1987, when no precipitation occurred. The annual mean precipitation is 12.31 inches. The maximum monthly snowfall recorded at the Pocatello airport was 37.7 inches of snow in December 1983.

The predominant wind direction is from the southwest, and the mean annual wind speed is 10.2 miles per hour (mph) as measured at the airport. Simplot also measures wind speed and direction at two locations. A preliminary evaluation of Simplot's data indicates that localized topography influences wind direction in the vicinity of the facilities.

The maximum mean number of days with thunderstorms occurs in the summer. The mean number of days with thunderstorms is 15.3 for the summer months, June through August. These storms occur mainly in the afternoon and are usually brief. Due to the dryness of the air, little rainfall reaches the ground (NOAA, 1989).

Evaporation is greatest in the summer, June through August (29.76 inches for the 3-month period) and lowest in the winter, December through February (3.36 inches for the three-month period). Mean evaporation was estimated with a form of the Penman equation using the parameters of wind speed, mean air temperature, mean dew point temperature, and daily solar radiation (NOAA, 1982). The annual mean evaporation is 61.14 inches.

Simplot also measures wind speed and direction at two locations. The first Simplot site (Site 1) is located north of Simplot and Highway I-86 near the City of Pocatello sewage treatment plant and monitors wind speed, direction, and temperature at the 65-foot level of the monitoring tower. The second Simplot site (Site 7) is located approximately 1 mile south-southeast of Site 1 on a hill at an elevation of approximately 400 feet above the Simplot plant grade. Meteorological stations at Site 7 monitors wind speed and direction at the 10-meter level above local ground level. Sites 1 and 7 have been continuously operating since 1976 and 1986, respectively.

A preliminary comparison of the Pocatello airport and Simplot Site 1 data show that although the two stations are only about 4 miles apart, the local topography of the Bannock Range influences the local wind patterns. This influence is evidenced by wind roses for the two locations provided in Figures 3-5 and 3-6. The Pocatello airport data (see Figure 3-5) shows a prevailing wind direction from the south-southwest with a strong predominance of wind from the entire southwest quadrant. The Site 1 data for the only year currently available, 1983, show a strong predominance for a southeast wind and a secondary predominance from the southwest to west-southwest directions.

3.1.5 Air Quality

A discussion of air quality in terms of trends, existing ambient air monitoring sites, PM_{10} non-attainment area, and ambient air quality monitoring programs is provided below. A discussion of emissions inventories is presented in Section 6.2.1.

3.1.5.1 Trends

The ambient air quality in the Pocatello area is classified as in attainment of all federally mandated standards for criteria pollutants with the exception of particulate matter.

Currently the Pocatello area is listed as a non-attainment area for PM_{10} (particulate matter less than 10µm). This non-attainment area is discussed in Section 3.1.5.3.

3.1.5.2 Existing Ambient Air Quality Monitoring Sites

Over the past 20 years, ambient air quality monitoring has been performed by the State of Idaho, Simplot and FMC to ascertain and monitor regional and local trends in ambient air quality. This monitoring has focused primarily on EPA National Ambient Air Quality Standards (NAAQS).

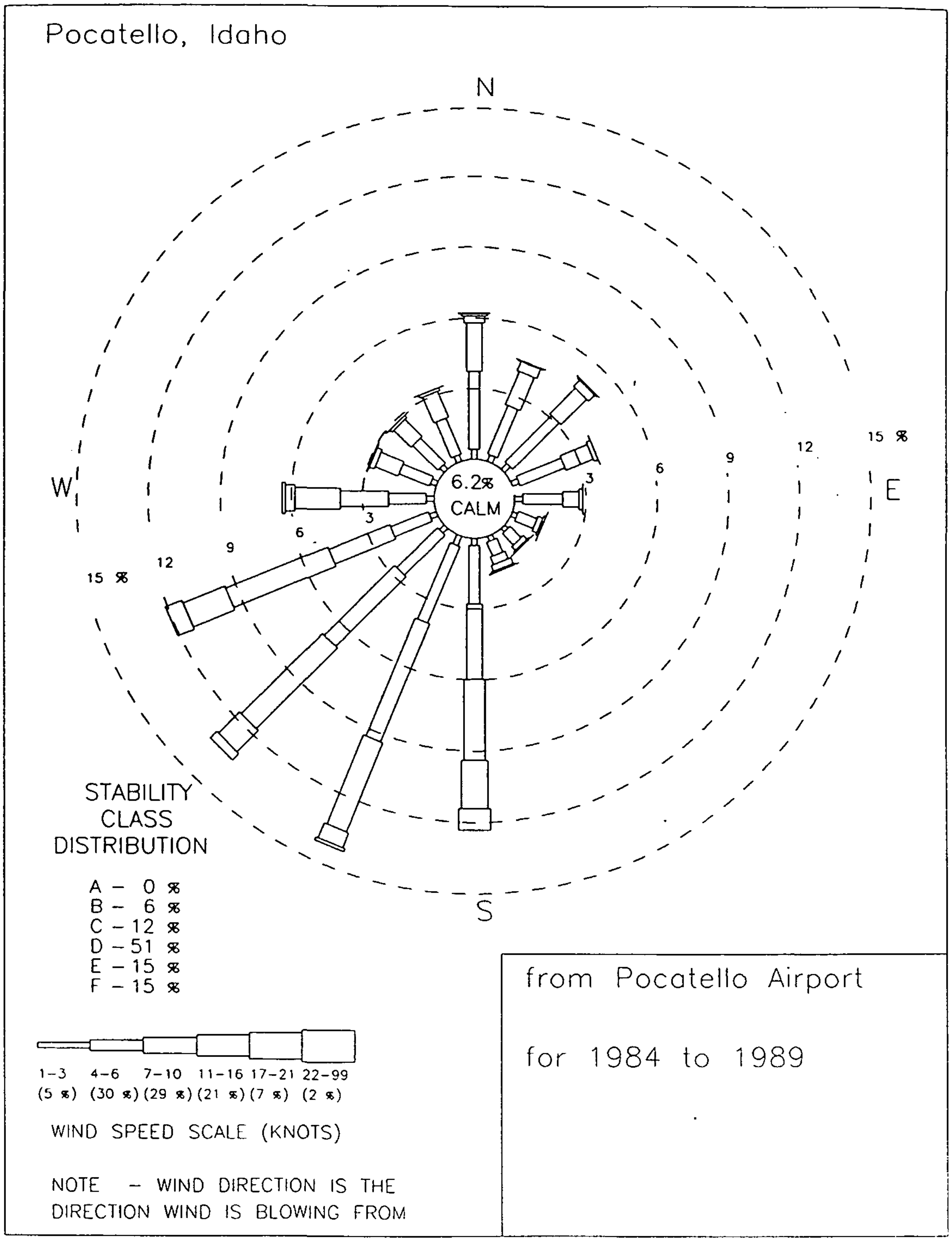


Figure 3-5 Wind Rose from Pocatello Airport

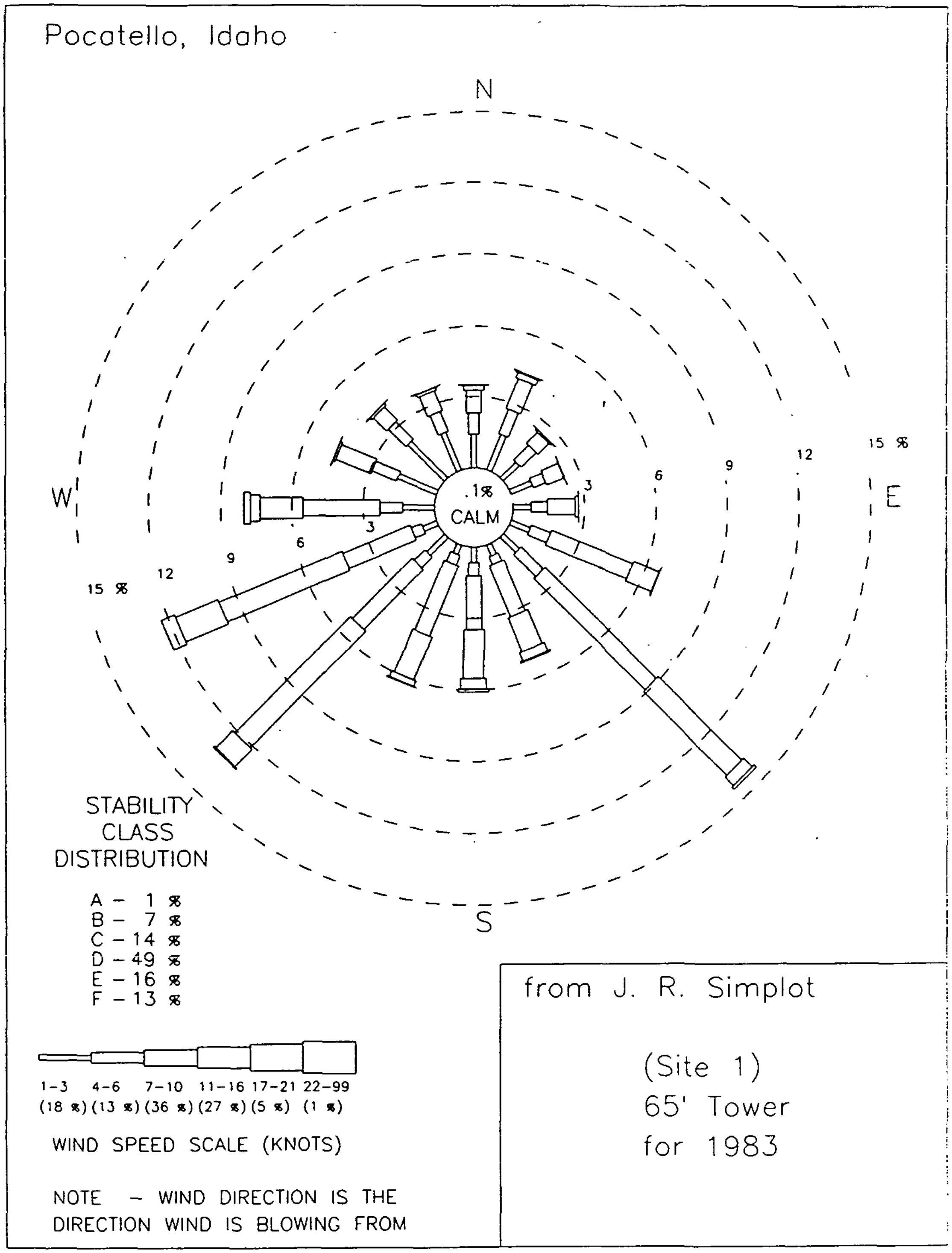


Figure 3-6 Wind Rose from Simplot Site 1

Historically, monitoring has been conducted for total suspended particulate (TSP) matter and sulfur dioxide (SO_2). In approximately 1971-72, the State of Idaho installed SO_2 and TSP monitors at the City of Pocatello sewage treatment plant (STP). In early 1986, this equipment was augmented by PM_{10} monitors. Additional PM_{10} monitors were added in 1988 at the Chubbuck School, about 3 to 4 miles northeast of Simplot; in 1988 at Idaho State University, about 3 to 4 miles southeast of Simplot; and at the intersection of Gould and Garrett Way, about 3 to 4 miles southeast of Simplot.

Since 1976, Simplot has conducted SO_2 monitoring at Site 1 in close proximity to the State of Idaho's STP monitoring site as well as at 3 other sites: one north of the Rowland creamery, one in the vicinity of the Simplot water treatment ponds, and one in Chubbuck approximately 1/4 mile from Rio Vista. In 1984, an additional SO_2 monitor was added to Site 7 of Simplot's network. Site 7 is located approximately 1 mile south-southeast of Site 1 and was identified by atmospheric dispersion modeling conducted for an air quality permit for Simplot as the calculated point of maximum SO_2 concentrations impacting on local elevated terrain.

FMC has conducted a program of particulate monitoring at three sites since 1975. TSP was monitored at a site within about 50 feet of the State of Idaho's STP monitoring station. In addition to the FMC STP site, two TSP monitors were located within the FMC plant boundary, one upwind west-southwest of the main FMC facility and another in the northeast corner of the FMC plant boundary. In July 1984, FMC added PM_{10} monitor at the FMC STP site. The upwind and northeast sites were similarly changed to PM_{10} monitors in May 1988. Monitoring frequency at all sites is one sample every 6 days.

3.1.5.3 PM_{10} Non-Attainment Area

The Pocatello area is currently listed as a PM_{10} non-attainment area. This area covers approximately 232 square miles and extends from the Bannock Paving - FMC - Simplot industrial complex in the northwest corner of the area, over the City of Pocatello, and finally southeast to Ash Grove Cement which forms the southeast corner of the area. Historically, the same approximate area was also listed as a TSP non-attainment area although the TSP non-attainment area covered a slightly larger area than the current PM_{10} area. Under the Clean Air Act Amendments of 1990, the State of Idaho is required to prepare a State Implementation Plan (SIP) designed to bring this and other PM_{10} non-attainment areas into compliance. A SIP is currently being prepared. One feature of the SIP development work includes an attempt to identify or apportion the individual contributions of local PM_{10} sources to ambient air quality monitoring levels. The results of this work are not yet final.

3.1.5.4 *Ambient Air Quality Monitoring Programs*

This section summarizes existing ambient air quality monitoring programs and the parameters measured.

Particulate Monitoring. As described in Section 3.1.5.2, both the State of Idaho and FMC have conducted particulate monitoring in the Pocatello area for many years. Data taken by the State of Idaho at monitoring stations near both facilities have shown exceedances of the National Ambient Air Quality Standard for PM_{10} (150 $\mu g/m^3$) on a frequency greater than once per year. These and prior State of Idaho monitoring data for TSP have been used as the basis for the determination of first the TSP, and later the PM_{10} non-attainment area.

SO_2 Monitoring. Ambient SO_2 monitoring has been conducted in the Pocatello area for many years. Since Simplot represents the primary source of SO_2 emissions in the Pocatello area, Simplot has operated several SO_2 monitors at several locations. Data from these sites are used to show compliance with State and Federal ambient air quality standards and ambient air quality permit conditions. The highest SO_2 concentrations at Simplot Site 1 (north of the plant) are typically observed during moderate wind speeds from the southwest. The highest concentrations at Simplot Site 7 are typically observed during temperature inversions and low wind speed.

Maximum SO_2 concentrations for various averaging times observed during 1991 at both Simplot monitoring sites compare with the applicable EPA air quality standards as follows:

Averaging Time	Concentration (ppm)		
	Site 1	Site 7	Standard
1-hour	0.13	0.24	none
3-hour	0.11	0.12	0.50
24-hour	0.035	0.039	0.14
Annual	0.0040	0.0024	0.03

The recovery rates for the above data were 95 and 86 percent for Sites 1 and 7, respectively. These Simplot data indicate that air quality standards were met.

Fluoride Monitoring. Process operations at the FMC and Simplot facilities result in the release of fluoride emissions to the environment. Under State of Idaho air quality rules, fluoride levels in food and forage material are required to be monitored in vegetation near the plant. Fluoride (forage) sampling in the area has been conducted since the 1950s. The Idaho fluoride standards are as follows:

Time Period	Standard (ppm)
Annual Limit	40 (arithmetic mean)
Bimonthly	60 (2 consecutive months)
Monthly	80 (no exceedances)

Historically, elevated levels of forage fluoride have been observed in the immediate vicinity of the FMC and Simplot facilities. In a recent sampling study of the 1990 growing season (June through August), 21 sampling sites were studied. These sites were located between 1 and 5 miles of the plants and were oriented radially northwest, northeast, southeast and southwest of the plant. Observations during the period showed that fluoride levels exceeded 100 ppm in 2 of 21 sample areas. Four of 21 were in the 50 to 100 ppm range, 6 areas were between 26 and 49 ppm, and 9 of 21 were between 10 and 25 ppm. Vegetation from areas having the highest fluoride readings typically were to the east and southeast of the facilities. Vegetation in these areas is sparse and consists primarily of sagebrush and scrubgrass.

3.1.6 Soil Types for the Eastern Michaud Flats Site and Vicinity

The primary source of information on soil types in vicinity of the EMF site is the Soil Conservation Service (SCS) which has conducted surveys for this particular geographic region. The soil profile, as described in SCS surveys, extends from the surface down into the underlying unconsolidated material. This underlying unconsolidated material is devoid of plant roots and burrowing macroinvertebrates, and does not support microbiological activity. Its mineral structure has not been altered by biological activity.

Soils form in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind or segment of the landscape. During a soil survey, the characteristics of each soil-association are recorded. These characteristics include the color, texture, size, and shape of soil aggregates; kind and amount of rock fragments; and the distribution of plant roots. Prediction of soil behavior is based not only on soil properties but also on such variables as climate and biological activity. Results of the soil surveys are published by the Department of Agriculture.

The following two soil surveys address soils in the vicinity of the EMF site:

- The Fort Hall Area, including parts of Bannock, Bingham, Caribou, and Power Counties (released in March 1977)
- Bannock County Area, including parts of Bannock and Power Counties (released in September 1987)

General soil maps from both of the soil surveys listed above were "spliced together" to obtain a composite general soil map for the EMF site geographical area shown in Figure 3-7. It should be noted that the soil associations in the general soil map obtained from the Fort Hall area soil survey and from the Bannock County Area soil survey do not entirely match where one survey area overlaps with the other. Differences in the maps are due not only to differences in the occurrence of soil patterns but also to the different times (nearly ten years apart) at which the two soil surveys were conducted. The blending of unmatched soil associations between the two surveys is shown by the dotted lines on Figure 3-7.

The soil associations in the EMF site and vicinity are depicted by different colors in Figure 3-7. A soil association consisting of one or more major soils and at least one minor soil is named for the major soils. The soils in one association may occur in another, but in different combinations.

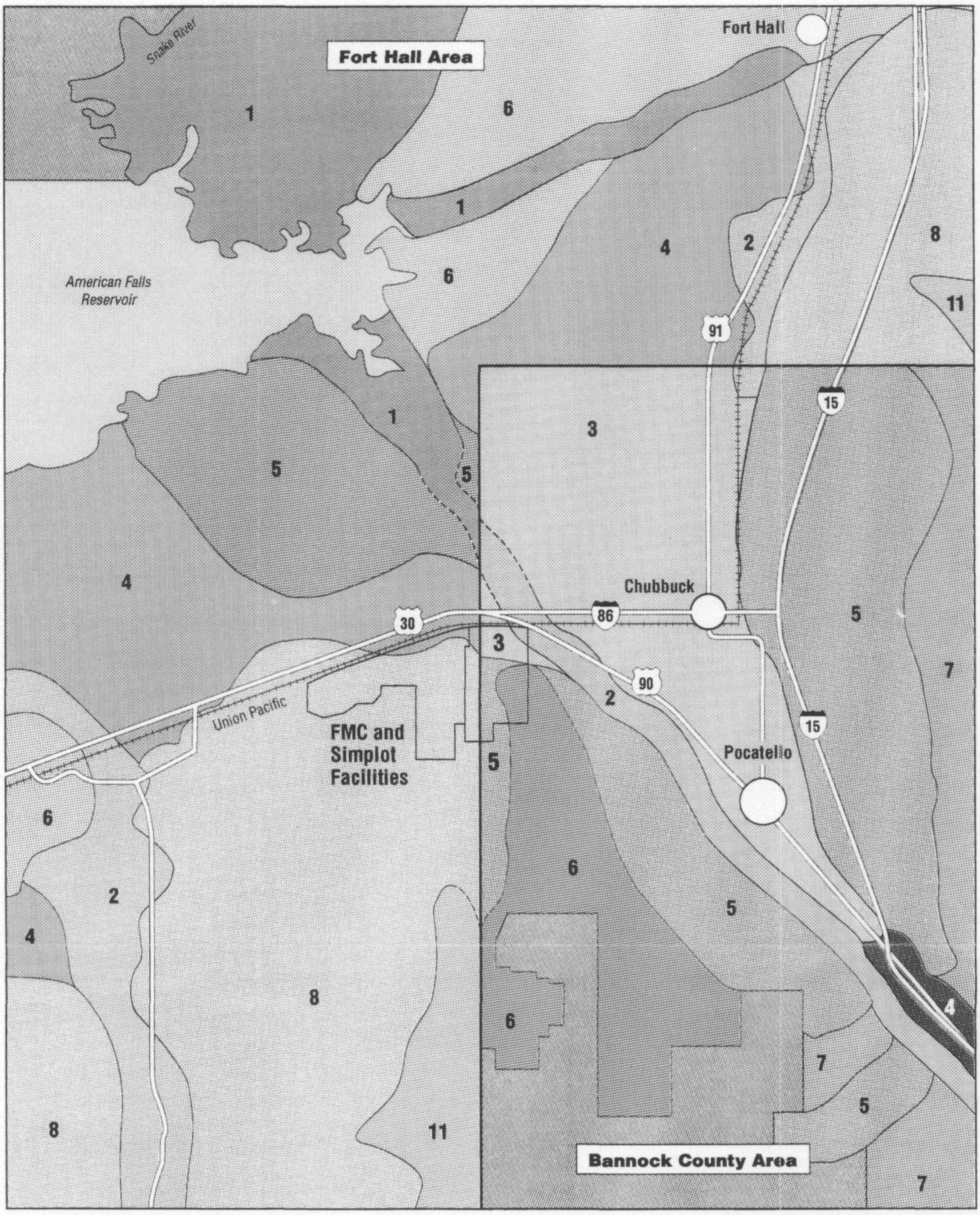
In Figure 3-7, soil associations are grouped into general kinds of landscapes (e.g., flood plain, alluvial terrace, high terrace). Table 3-1 lists the six landscapes found in the vicinity of the EMF site and the soil associations from both surveys included under each landscape.

3.1.6.1 *Fort Hall Area Soil Types*

The Fort Hall Area soil survey was issued by the SCS in March 1977. The survey includes most of the soils to the north and west of the facilities. The western portion of the FMC facility is located within this soil survey area, with the remainder of the facility in the Bannock County Area. Table 3-2 summarizes selected chemical and physical soil characteristics of the Fort Hall Area soil associations within a 5-mile radius of the facilities.

3.1.6.2 *Bannock County Area Soil Types*

The Bannock County Area soil survey was issued by the United States Department of Agriculture SCS in September 1987. The eastern portion of the FMC facility is located within this soil survey area. Areas to the south and east of the facility are also included in this area. Table 3-3 summarizes selected chemical and physical soil characteristics of the Bannock County Area soil associations within a 5-mile radius of the facilities.



Soil Associations

Fort Hall Area (1977)

Nearly Level to Moderately Sloping Soils on Bottom Lands, Low Terraces, and Alluvial Fans

1 Snake Philbon association: Nearly level, deep and very deep silt loams and peats on bottom lands

Nearly Level to Moderately Steep Soils on Alluvial Terraces and Fans

2 Penoyer-Parehat association: Nearly level and very gently sloping, deep silt loams on bottom lands and low terraces

Nearly Level to Very Steep Soils on High Fans and Low Dissected Plateaus

4 Paniogue-Declo association: Nearly level to moderately sloping loams and silt loams on alluvial fans and terraces

5 Paniogue-Broncho association: Nearly level to moderately steep loams and gravelly loams on alluvial fans and terraces

6 Tindahay-Escalante association: Nearly level to strongly sloping loamy coarse sands and sandy loams on alluvial fans and terraces

Nearly Level to Very Steep Soils on High Fans and Low Dissected Plateaus

8 Pocatello-Wheeler-Portneuf association: Nearly level to very steep silt loams on loess-mantled basalt plains and dissected low plateaus

Nearly Level to Steep Soils on Uplands and Mountain Foot Slopes

11 Neeley-Hondoho association: Nearly level to steep silt loams and very cobbly loams on loess-mantled benches and uplands

Unmapped

Bannock County Area (1987)

Soils on Flood Plains and Low Terraces

2 Inkom-Joevar: Very deep, moderately well drained and well drained soils that formed in silty alluvium

Soils on High Terraces

3 Arimo-Downey-Bahem: Very deep, well drained soils that formed in loess and silty alluvium overlying alluvial sand, gravel, cobbles, and stones

Lava Flows and Soils on Basalt Flows

4 Lava flows – McCarey-McCarey Variant: Lava flows, and moderately deep and shallow, well drained soils that formed in loess, silty alluvium, and material weathered from basalt

Soils on Fan Terraces and Foothills

5 Ririe-Rexburg-Lanoak: Very deep, well drained soils that formed in loess and in silty alluvium derived from loess

Soils on Foothills and Mountains

6 Camelback-Hades-Valmar: Very deep to moderately deep, well drained calcareous soils that formed in alluvium colluvium, and residuum derived from quartzite and related rocks

7 Cederhill-Ireland: Very deep and moderately deep, well drained calcareous soils that formed in alluvium colluvium, and residuum derived from limestone

Unmapped

----- Modified from original soils maps to provide continuity between associated soil types

Scale (miles) 0 1 2 3

Numbers on soil associations correspond to original numbers on the SCS soil surveys for Fort Hall Area and Bannock County Area.

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Figure 3-7 Soil Types in the EMF Site and Vicinity

Table 3-1
SOIL TYPES IN THE VICINITY OF FMC AND SIMPLOT FACILITIES

FORT HALL AREA	BANNOCK COUNTY AREA
Soils on Flood Plains and Low Terraces	
Snake-Philbon: Nearly level, deep and very deep silt loams and peats on bottom lands	Inkom - Joevar: Very Deep, moderately well drained and well drained soils that formed in silty alluvium.
Soils on Alluvial Terraces and Fans	
Paniogue-Declo: Nearly level to strongly sloping loamy coarse sands and sandy loams on alluvial fans and terraces Paniogue-Broncho: Nearly level to moderately steep loams and gravelly loams on alluvial fans and terraces Tindahay-Escalante: Nearly level to strongly sloping loamy coarse sands and sandy loams on alluvial fans and terraces	
Soils on High Terraces	
Pocatello-Wheeler-Portneuf: Nearly level to very steep silt loams on loess-mantled basalt plains and dissected low plateaus	Arimo-Downey-Bahem: Very deep, well drained soils that formed in loess and silty alluvium overlying alluvial sand, gravel, cobbles, and stones
Soils on Fan Terraces and Foothills	
	Ririe-Rexburg-Lanoak: Very deep, well drained soils that formed in loess and in silty alluvium derived from loess
Soils on Foothills and Mountains	
Neeley-Hondoho: Nearly level to steep silt loams and very cobbly loams on loess-mantled benches and uplands.	Camelback-Hades-Valmar: Very deep to moderately deep, well drained noncalcareous soils that formed in alluvium, colluvium, and residuum derived from quartzite and related rocks.

Table 3-2
SELECTED SOIL PROPERTIES: SCS SOIL SURVEY
FORT HALL AREA, IDAHO

Soil Series	Depth (in feet) to: Bedrock	Seasonal high water table	Depth (in inches) from surface	USDA texture	Unified Soil* Classification	Permeability in cm/S	pH	Salinity
Snake	>5	1.5 - 4	0 - 58	Heavy silt loam and silty clay loam.	CL	4×10^{-5} - 1.4×10^{-4}	7.9 - 9.9	None
Philbon	>5	0	0 - 22 22 - 38	Peat Mucky silt loam	Pt OL	4×10^{-4} - 1.4×10^{-3} 4×10^{-4} - 1.4×10^{-3}	6.6 - 7.3 6.6 - 8.4	None None
Paniogue	>5	>5	0 - 28 28 - 60	Loam and silt loam Coarse sand and gravelly coarse sand	ML or CL-ML SP or SP-SM	4×10^{-4} - 1.4×10^{-3} >1.4×10^{-2}	7.4 - 9.6 8.5 - 9.0	Low, except moderate in some areas
Declo	>5	>5	0 - 47 47 - 60	Loam and silt loam Loamy coarse sand and coarse sand	ML SM	4×10^{-4} - 1.4×10^{-3} 4×10^{-3} - 1.4×10^{-2}	7.4 - 8.4 7.9 - 8.4	None None
Broncho	>5	>5	0 - 14 14 - 60	Gravelly loam Very gravelly coarse sand.	GM or SM GW or GP	4×10^{-4} - 1.4×10^{-3} 1.4×10^{-2}	7.9 - 8.4 8.5 - 9.0	None None
Tindahay	>5	>5	0 - 24 24 - 60	Loamy coarse sand and sandy loam. Coarse sand and sand	SM SP-SM or SM	4×10^{-3} - 1.4×10^{-2}	7.4 - 7.8	None
Escalante	>5	>5	0 - 60	Sandy loam and fine sandy loam	SM	4×10^{-3} - 1.4×10^{-2}	7.4 - 7.8	None, except moderate in some areas
Pocatello	>5	>5	0 - 60	Silt loam	ML	4×10^{-3} - 1.4×10^{-2}	7.9 - 9.6	None
Wheeler	>5	>5	0 - 60	Silt loam	ML	4×10^{-3} - 1.4×10^{-2}	7.4 - 8.4	None
Portneuf	>5	>5	0 - 60	Silt loam	ML, CL, or CL-ML	4×10^{-3} - 1.4×10^{-2}	6.6 - 9.0	None above a depth of 24", moderate below 24"
Neeley	>5	>5	0 - 60	Silt loam	ML	4×10^{-4} - 1.4×10^{-3}	7.4 - 9.6	None
Hondoho	>5	>5	0 - 24 24 - 60	Cobbly and very cobbly loam Cobbly and very cobbly sandy clay loam	GC GC	4×10^{-4} - 1.4×10^{-3} 4×10^{-4} - 1.4×10^{-3}	6.6 - 8.4 7.9 - 8.4	None None

* Notes explaining Unified Soil Classification abbreviations can be found on page 3-35.

Table 3-2 (Cont'd)

Notes:

GW	Well-graded gravels and gravel-sand mixtures, little or no fines.
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures.
SW	Well graded sands and gravelly sands, little or no fines.
SP	Poorly graded sands and gravelly sands, little or no fines.
SM	Silty sands, sand-silt mixture.
SC	Clayey sands, sand-clay mixtures.
ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL	Organic silts and organic silty clays of low plasticity.
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.
CH	Inorganic clays of high plasticity, fat clays.
OH	Organic clays of medium to high plasticity.
PT	Peat, muck, and other highly organic soils.

Table 3-3
SELECTED SOIL PROPERTIES: SOIL CONSERVATION SERVICE SOIL SURVEY - BANNOCK COUNTY AREA, IDAHO

Soil Series	Depth (in inches) from surface	USDA texture	Unified Soil* Classification	Permeability in cm/S	pH	Salinity in µmhos/cm
Inkom	0 - 7	Silt loam	ML, CL-ML	4×10^{-4} - 1.4×10^{-3}	7.4 - 8.4	<4
	7 - 60	Silt loam	CL, CL-ML	4×10^{-4} - 1.4×10^{-3}	7.4 - 8.4	<4
Joevar	0 - 4	Silt loam	ML, CL-ML	4×10^{-4} - 1.4×10^{-3}	6.6 - 7.8	<2
	4 - 60	Silt loam	ML, CL-ML	4×10^{-4} - 1.4×10^{-3}	7.4 - 8.4	<2
Arimo	0 - 18	Silt loam	ML, CL-ML	4×10^{-4} - 1.4×10^{-3}	6.6 - 7.8	<2
	18 - 33	Silt loam	ML, CL-ML	4×10^{-4} - 1.4×10^{-3}	7.4 - 8.4	<2
	33 - 60	Extremely gravelly coarse sand	GP	$>1.4 \times 10^{-3}$	7.4 - 8.4	<2
Downey	0 - 17	Gravelly silt loam	CL-ML, Ml	4×10^{-4} - 1.4×10^{-3}	6.6 - 8.4	<2
	17 - 60	Very gravelly coarse sand, extremely gravelly coarse sand	GP	4×10^{-4} - 1.4×10^{-3}	7.4 - 8.4	<2
Bahem	0 - 11	Silt loam	ML, CL-ML	4×10^{-4} - 1.4×10^{-3}	7.4 - 8.4	<2
	11 - 49	Silt loam, silt	ML, CL-ML	4×10^{-4} - 1.4×10^{-3}	7.4 - 8.4	<2
	49 - 60	Extremely cobbly sand, extremely stony sand.	GP, GP-GM	4×10^{-4} - 1.4×10^{-3}	—	<2
Ririe	0 - 12	Silt loam	ML, CL-ML	4×10^{-4} - 1.4×10^{-3}	6.6 - 8.4	<2
	12 - 60	Silt loam	ML, CL-ML	4×10^{-4} - 1.4×10^{-3}	7.4 - 9.0	<2
Rexburg	0 - 10	Silt loam	ML, CL-ML	4×10^{-4} - 1.4×10^{-3}	6.1 - 7.8	<2
	10 - 26	Silt loam	ML, CL-ML	4×10^{-4} - 1.4×10^{-3}	6.6 - 7.8	<2
	26 - 60	Silt loam, silt	ML	4×10^{-4} - 1.4×10^{-3}	7.4 - 8.4	<2
Lanoak	0 - 22	Silt loam	ML	4×10^{-4} - 1.4×10^{-3}	6.1 - 7.8	<2
	22 - 60	Silt loam	CL, CL-ML	4×10^{-4} - 1.4×10^{-3}	6.6 - 7.8	<2
Camel-back	0 - 21	Gravelly silt loam	GM-GC, GM	4×10^{-4} - 1.4×10^{-3}	6.1 - 7.3	<2
	21 - 42	Extremely gravelly silt loam, extremely cobbly silt loam	GM-GC, GC	4×10^{-4} - 1.4×10^{-3}	6.1 - 7.3	<2
	42	Unweathered bedrock	—	—	—	—
Hades	0 - 7	Gravelly silt loam	CL-ML	4×10^{-4} - 1.4×10^{-3}	5.6 - 7.3	<2
	7 - 60	Gravelly silt loam, gravelly silty clay loam.	CL, GC	1.4×10^{-4} - 4×10^{-4}	5.6 - 8.4	<2
Valmar	0 - 9	Extremely stony silt loam	GM, GM-GC	4×10^{-4} - 1.4×10^{-3}	6.1 - 7.3	<2
	9 - 14	Very stony silt loam, very cobbly silt loam	GM-GC, GC	4×10^{-4} - 1.4×10^{-3}	6.6 - 7.8	<2
					6.6 - 7.8	<2
	14 - 24	Extremely stony silt loam, extremely flaggy silt loam	GM-GC, GC	4×10^{-4} - 1.4×10^{-3}		
	24	Unweathered bedrock	—	—	—	—

*Notes explaining Unified Soil Classification abbreviations can be found on page 3-35.

3.1.6.3 Soil Associations between the Fort Hall Area and Bannock County Area

As mentioned previously Figure 3-7 is a composite of the general soil survey maps for the Bannock County and Fort Hall areas. Soil associations at the adjoining edges of the two maps are listed in Table 3-4. The adjacent soils from the two general soil survey maps are listed side by side (e. g., the Inkom-Joevar association from the Bannock Area adjoins the Snake-Philbon association in the Fort Hall Area.)

SCS descriptions of each soil association are also provided in Table 3-4.

3.1.7 Ecology

Terrestrial and aquatic ecology is summarized in this section. Species lists are provided in Table 3-5. The discussion and listings are by no means exhaustive or all inclusive. This information will be supplemented during Phase I of the RI (see Section 6.8).

3.1.7.1 Terrestrial Biota

The Eastern Michaud Flats site is within the Snake River Plains segment of the Great Basin Floristic Division (Minshall, et al., 1989). The site appears to be within the sagebrush steppe which is characterized by *Artemisia* and *Agropyron*. Cronquist, et al (1972) also places this area within the sagebrush community with associated annual and perennial weeds common in disturbed habitats.

Common associated shrubs include bitterbrush and tall green rabbitbrush that grades to low sagebrush in lower altitudes. Other plants can include chokeberry, snowberry, mormon teas, winterfat, spiny hopsage, and little leaf horse brush (Benyus, 1989). The understory supports grasses that may include bluebunch wheatgrass, Idaho fescue, needle-and-thread grass, and Sandberg's bluegrass. Sagebrush-steppe occurs in regions of hot summers and cold winters with annual precipitation between 8 and 15 inches, falling mostly as snow in winter.

Table 3-4
ASSOCIATIONS BETWEEN FORT HALL AND BANNOCK COUNTY AREA SOIL SURVEYS

Bannock Area[a]		Fort Hall Area[b]	
2.[c]	Inkom - Joevar: Very deep, moderately well drained and well drained soils that formed in silty alluvium	1.	Snake-Philbon: Nearly level, deep and very deep silt loams and peats on bottom lands
3.	Arimo-Downey-Bahem: Very deep, well drained soils that formed in loess and silty alluvium overlying alluvial sand, gravel cobbles, and stones	4.	Paniogue-Declo: Nearly level to strongly sloping loamy coarse sands and sandy loams on alluvial fans and terraces
5.	Ririe-Rexburg-Lanoak: Very deep, well drained soils that formed in loess and in silty alluvium derived from loess	8.	Pocatello-Wheeler-Portneuf: Nearly level to very steep silt loams on loess-mantled basalt plains and dissected low plateaus

Notes:

(a) After USDA, 1987

(b) After USDA, 1977

(c) Numbers refer to United States Department of Agriculture Soil Conservation Service soil classifications for general soil types.

Table 3-5
PRELIMINARY LIST OF SPECIES THAT MAY OCCUR IN THE VICINITY OF THE EMF SITE

Item	Common Name	Scientific Name
Terrestrial Plants	Sage	*Artemesia*
	Chokecherry	*Prunus virginiana*
	Snowberry	*Symphoricarpus oreophilus*
	Mormon tea	*Ephedra spp.*
	Winterfat	*Eurotia lanata*
	Spiny hopsage	*Grayia spinosa*
	Littleleaf horse brush	*Tetradymia glabrata*
	Bluebunch wheatgrass	*Agropyron spicatum*
	Idaho fescue	*Festuca idahoensis*
	Needle-and-thread grass	*Stipa comata*
	Secunda bluegrass	*Poa sandbergii*
Wildlife	Western toad	*Bufo boreas*
	Western fence lizard	*Sceloporus occidentalis*
	Sagebrush lizard	*Sceloporus graciosus*
	Short-horned lizard	*Phrynosoma douglassi*
	Western rattlesnake	*Crotalus viridis*
	Gopher snake	*Pituophis catenifer*
	Sage grouse	*Centrocercus urophasianus*
	Common nighthawk	*Chordeiles minor*
	Common poorwill	*Phalaenoptilus nuttallii*
	Western meadowlark	*Sturnella neglecta*
	Sage sparrow	*Amphispiza belli*
	Brewer's sparrow	*Spizella breweri*
	Green-tailed towhee	*Chlorura chlorura*
	Sage thrasher	*Oreoscoptes montanus*
	Canyon wren	*Catherpes mexicanus*
	Rock wren	*Salpinctes obsoletus*
	Barn swallow	*Hirundo rustica*
	Say's phoebe	*Sayornis saya*
	Turkey vulture	*Cathartes aura*
	Red-tailed hawk	*Buteo jamaicensis*
	Rough-legged hawk	*Buteo lagopus*
	Great blue heron	*Ardea herodias*
	Black-crowned night heron	*Nycticorax nycticorax*
	Double-crested cormorant	*Phalacrocorax auritus*

Table 3-5 (Cont'd)

Item	Common Name	Scientific Name
Wildlife (Cont'd)	Canada goose	*Branta canadensis*
	Mallard duck	*Anas platyrhynchos*
	Sagebrush vole	*Lagurus curtatus*
	Canyon mouse	*Peromyscus crinitus*
	Ord's kangaroo rat	*Dipodomys ordi*
	Great Basin pocket mouse	*Perognathus parvus*
	Bushytail woodrat	*Neotoma fuscipes*
	Pygmy rabbit	*Sylvilagus idahoensis*
	Cottontail rabbit	*Sylvilagus sp.*
	Blacktail jackrabbit	*Lepus californicus*
	Longtail weasel	*Mustela frenata*
	Striped skunk	*Mephitis mephitis*
	Yellow belly marmot	*Marmota flaviventris*
	Townsend ground squirrel	*Citellus townsendi*
	Deer mouse	*Peromyscus maniculatus*
	Pronghorn antelope	*Antilocapra americana*
	Mule deer	*Odocoileus hemionus*
	American badger	*Taxidea taxus*
	Gray fox	*Urocyon cinereoargenteus*
	Bobcat	*Lynx rufus*
	Coyote	*Canis latrans*
Aquatic	Longnose dace	*Rhinichthys cataractae*
	Speckled dace	*Rhinichthys osculus*
	Redside shiner	*Richardsonius balteatus*
	Mountain whitefish	*Prosopium williamsonii*
	Bluehead sucker	*Catostomus discobolus*
	Mottled sculpin	*Cottus bairdi*
	Paiute sculpin	*Cottus beldingi*
	Utah chub	*Gila atraria*
	Cutthroat trout	*Oncorhyncus clarki*
	Rainbow trout	*Oncorhyncus gairdneri*
	Brown trout	*Salmo trutta*
	Brook trout	*Salvelinus fotinalis*
	Utah sucker	*Catostomus ardens*
	Carp	*Cyprinus carpio*

The sagebrush-steppe vegetation provides important wildlife habitat for numerous species. Many of these species have developed special adaptations to occupy the dry conditions typical of the vegetation type. Amphibians and common reptiles occurring in the sagebrush-steppe include the western toad, the western fence lizard, sagebrush lizard, short-horned lizard, western rattlesnake, and gopher snake. Bird species that nest on the ground include sage grouse, common nighthawk, common poorwill, and western meadowlark. Species that nest in shrubs include sage sparrow, Brewer's sparrow, green-tailed towhee, and sage thrasher. It is recognized that sage grouse is currently a species of concern to many wildlife and resource managers. In some parts of its range, especially in areas where development has replaced the sagebrush system, the sage grouse may become listed as threatened or endangered. The canyon wren, rock wren, barn swallow, and Say's phoebe may nest in the small rock outcrops that can be scattered throughout the shrub-steppe. Raptors, such as turkey vultures, red-tailed hawks, and nighthawks, and resident and migratory waterfowl, such as great blue herons, black-crowned night herons, double-crested cormorants, mallard ducks, and Canada geese, are also present.

Small mammals may include the sagebrush vole, canyon mouse, Ord's kangaroo rat, Great Basin pocket mouse, bushy-tailed woodrat, pygmy rabbit, cotton tail, and black-tailed jackrabbit. Also included among small mammals may be the long tail weasel, striped skunk, yellow belly marmot, Townsend ground squirrel, and deer mouse. Sagebrush-steppe vegetation provides year-round habitat for pronghorn antelope and winter range for mule deer. Mammalian predators include the American badger, gray fox, bobcat, and coyote.

Many of the bunchgrasses and other vegetation have been replaced by agricultural fields and grazing land. Principal industries in the area are irrigated agriculture (such as seed peas, potatoes, and wheat) and phosphate-ore processing. Agricultural fields and developed land provide limited habitat for wildlife. Most use occurs as feeding along the edge between wildland habitat and agricultural fields. Raptors may use these areas as hunting grounds.

3.1.7.2 *Aquatic Biota*

Summaries of various ecological studies of the Portneuf River performed to date are described below. It should be noted that the FMC and Simplot facilities are not the only entities which discharge or have discharged to the river. It should also be noted that Simplot ceased its discharge to the river in 1980.

According to Minshall and Andrews (1973) the Portneuf River between Pocatello and the American Falls Reservoir supports longnose dace, speckled dace, redside shiner, and mountain whitefish. It appears from this report that bluehead sucker, mottled sculpin, Paiute sculpin, Utah chub, cutthroat trout, rainbow trout, brown trout, brook trout, and Utah sucker are found upstream of the vicinity of the EMF site. Sampling by Low, et al. (1990) also indicate the presence of rainbow trout, Utah sucker, and carp in the Portneuf River.

Minshall and Andrews (1973) conducted water chemistry and aquatic sampling along the Portneuf River from near the Portneuf Dam, downstream to the American Falls Reservoir. The purpose of this study was to gather data on water quality and the distribution of benthic invertebrates that may be affected by agricultural practices and discharges from industrial and urban sources. During the period of study, both Simplot and FMC discharged directly into the river. Results showed that a viable trout fishery persists upstream and that flora and fauna are influenced to some extent by irrigation practices. In general, inputs from thermal springs have also contributed to differences in species composition along the Portneuf River. In the vicinity of the EMF site, water quality was reported to be degraded in terms of nutrients and fluoride and characterized by a dramatic reduction in invertebrate numbers and species. However, further downstream approximately 1.5 km (0.9 mile) from the plant discharges, there appeared to be improvement of the invertebrate fauna attributed to inflows of significant volumes of spring water which may dilute these constituents.

Buikema (1975) conducted benthic sampling in areas very close to Minshall's stations of 1972. By the time Buikema's work was begun, the FMC effluent entered the waterway approximately five meters upstream of the Simplot discharge. The work, completed for FMC Corporation, concluded that there was relatively low diversity of invertebrate species in the Portneuf River above the FMC effluent and that downstream of both effluents, there was no major impact from the discharges.

In 1977, Ecology Consultants (ERT) undertook further macrobenthic surveys in the Portneuf River (ERT, 1977). This work, contracted by Simplot, indicated that water quality near the FMC and Simplot discharges was characterized by increased nutrient concentrations such as ammonia, nitrite, nitrate, total nitrogen, orthophosphate, and total phosphate. From approximately 150 meters downstream of the discharges and further downstream, these constituents appeared to be diluted to levels near upstream values by river and spring water, as well as by biological activity. Periphyton growth was stimulated by the increased nutrients near the discharges, but downstream assemblages were similar to upstream algal communities. Benthic invertebrates found near the discharges were typical of those found in physically stressed environments and were species that were pollution tolerant. ERT did note, however, that "recovery" occurred at downstream locations, approximately 900 meters downstream of the Simplot discharge canal.

Work conducted by Johnson, et al. (1977) and Kent and Johnson (1979) addressed contaminant accumulation within American Falls Reservoir. These studies indicated that mercury and cadmium accumulate within fish tissue in the reservoir. The studies identified sewage effluent, irrigation drainage, or emissions from nearby phosphate and cement plants as possible sources (Johnson, et al. 1977 and Kent and Johnson, 1979 in Low and Mullins, 1990).

In a joint study conducted in 1988-89 by the U.S. Geological Survey (USGS) and U.S. Fish and Wildlife Service, water quality, bottom sediment, and biota in the area of the American Falls Reservoir were investigated to assess effects to these receptors caused by irrigation drainage (USGS, 1990). Of the trace elements found in the biota, mercury and selenium were measured at concentrations high enough to be harmful to wildlife or humans. Mercury concentrations in livers of double-crested cormorants, which are fish-eating birds, ranged from 6 to 6.20 micrograms per gram, dry weight, and were the highest of the birds measured. Selenium concentrations were highest in mallard duck livers, ranging from 6.6 to 41.8 micrograms per gram, dry weight. DDT derivatives and total PCBs were found in waterfowl eggs, some bird species, fish, and invertebrates. The study concluded that the irrigation drainage did not appear to stress general health of fish and waterfowl populations during the observation period. The authors did not observe waterfowl or fish die-offs during this period, and it appeared that nesting waterbird populations were increasing.

Fluoride accumulation and bone strength of tibiae were measured in carcasses of wild black-crowned night herons found dead at a fish hatchery downstream of the EMF site (Henny and Burke, 1990). This study reported that the birds had body burdens of fluoride and bending strength was lower for first year birds than older age classes, which may be attributed to differences in size. Interpretation of the data, however, was hampered by several factors: 1) the paucity of information concerning bone strength; 2) lack of data on age effects, and fluoride concentrations required to cause damage to wild birds; 3) lack of controls from fluoride-free areas; and 4) possible negative effects of storing frozen bones for approximately 2 years before testing.

The City of Pocatello assessed the possible chemical and biological effects of treated wastewater effluent discharged to the Portneuf River (City of Pocatello, 1989). The effluent, which discharges between Interstate 86 and Siphon Road, downstream of the FMC discharge, is the result of an activated sludge secondary treatment process. The water quality of the Portneuf River and the effluent were evaluated as well as the influence of the Batiste Springs complex. The evaluation indicated that the discharge was not completely mixed near the pool adjacent to the Batiste Spring fish hatchery, but that the Batiste Springs complex discharges such volumes of water that it, too, influences the quality of the river. Ammonia-nitrogen loading was observed in the Portneuf River and increased two orders of magnitude downriver at the hatchery.

Artificial substrates were used to collect data on macroinvertebrates upstream as well as downstream of the wastewater effluent. The study suggests that there is environmental stress associated with the wastewater treatment plant effluent discharge based on taxonomic analyses. The study found a predominance of toxic-tolerant organisms near the discharge and a reduction in species richness downstream. Fish populations were surveyed by electrofishing, and results indicated that populations of game fish (salmonids) and non-game fish (cyprinids, sculpins, and dace) fluctuate from year to year and season to season, which may be due to changes in water quality or habitat suitability. However, the sampling was hampered due to clogged block nets and difficulties with fish capture. Additionally, strays from the fish hatchery at Batiste Springs may have skewed the study results.

3.2 EMF SITE HYDROGEOLOGY

The geology of the EMF site is comprised of three distinct geologic settings. The Snake River Plain is representative of the geologic setting underlying the northern component of the EMF site, from approximately Highway 30 north into the flats. The foothills and mountains of the Bannock Range are representative of the geologic setting underlying the southern component of the site. The geologic setting below the central portion of the site (i.e., from Highway 30 south to the foothills) generally reflects that of the Snake River plain. However, during the 1990 study of the FMC facility, significant differences were determined. The actual geologic conditions beneath the Simplot facility are not well defined at this time. As discussed in the regional geology section (see Section 3.1), this area was subjected to a severe flood event that may have eroded the American Falls Lake Beds beneath the Simplot facility. Therefore, extrapolation of the geologic conditions from the FMC facility to the Simplot facility may not be appropriate. The locations of soil borings and subsurface soil profiles for the most recent FMC investigation are shown in Figure 3-8. The subsurface soil profiles are shown in Figure 3-9. Investigations scheduled in this Work Plan will develop data necessary to further delineate the variations observed in the existing data.

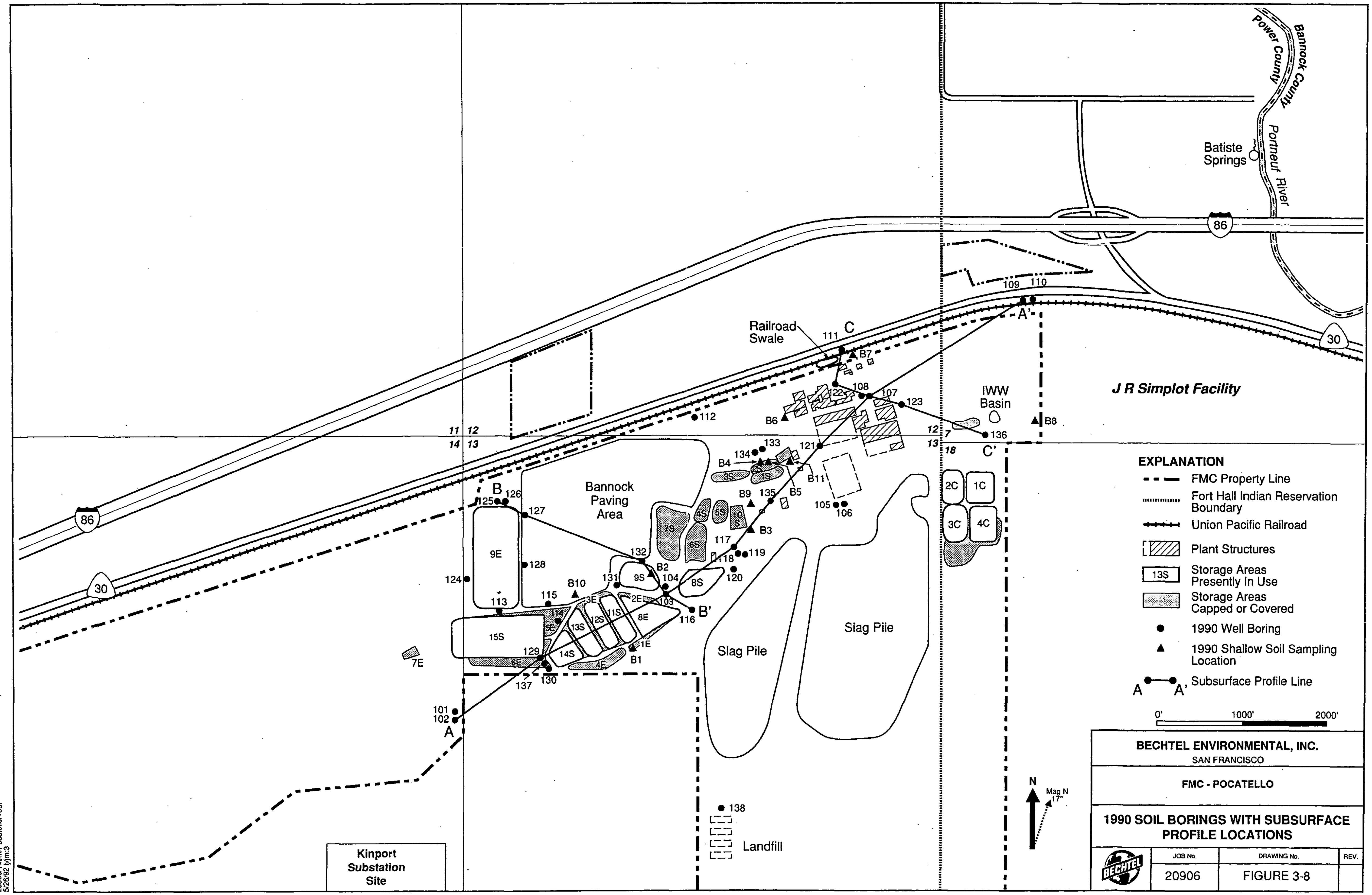
3.2.1 EMF Site Stratigraphy

Rhyolite of the Starlight Formation is buried beneath the FMC facility by unconsolidated deposits to depths exceeding 250 feet (FMC, 1991b). The rhyolite encountered beneath the FMC facility occurs as red, green, gray, and black ash-flow tuffs, often with flow-banded quartz and feldspar phenocrysts or mineralized lenticular gas cavities (lithophysae). Upper portions of the formation are typically weathered and highly fractured with calcium carbonate cementation. The rhyolite forms the lower boundary of the unconsolidated deposits, although this surface beneath the EMF site has not yet been adequately mapped.

The extensive flows of the Big Hole Basalt have been identified beneath most of the Simplot facility (Jacobson 1982, Ecology and Environment, 1988). However, the basalt flows either pinch out or are truncated by erosion in the westernmost portion of the Simplot facility and most of the FMC facility (FMC, 1991b; Jacobson, 1982, 1989).

Unconsolidated deposits occur beneath most of the EMF site where the deposits abut the rhyolite bedrock of the Bannock Range. Beneath the FMC facility, the deposits were identified as the Sunbeam Formation and occur as alternating discontinuous intervals of predominantly fine-grained sediments (silt with minor clay and fine-grained sand) and coarse-grained deposits (sand and gravel in sizes up to and including boulders) as shown in the FMC subsurface soil profiles in Figure 3-9 (FMC, 1991b). Deeper coarse-grained intervals tend to consist of mostly angular pea-size gravel derived from rhyolite and basalt. More shallow coarse-grained intervals consist of rounded cobbles of metamorphic lithologies, including quartzite. The change in gravel lithology with depth indicates a change in sediment during deposition of the unconsolidated deposits. The deepest gravels could represent the pediment gravel and the most shallow gravels may represent the depositional margin of the Michaud Gravel.

As described in the regional geology section (see Section 3.1), the American Falls Lake Beds occur beneath the northern portion of the EMF site north of the FMC facility (Jacobson, 1982). However, clay beds become discontinuous towards the FMC



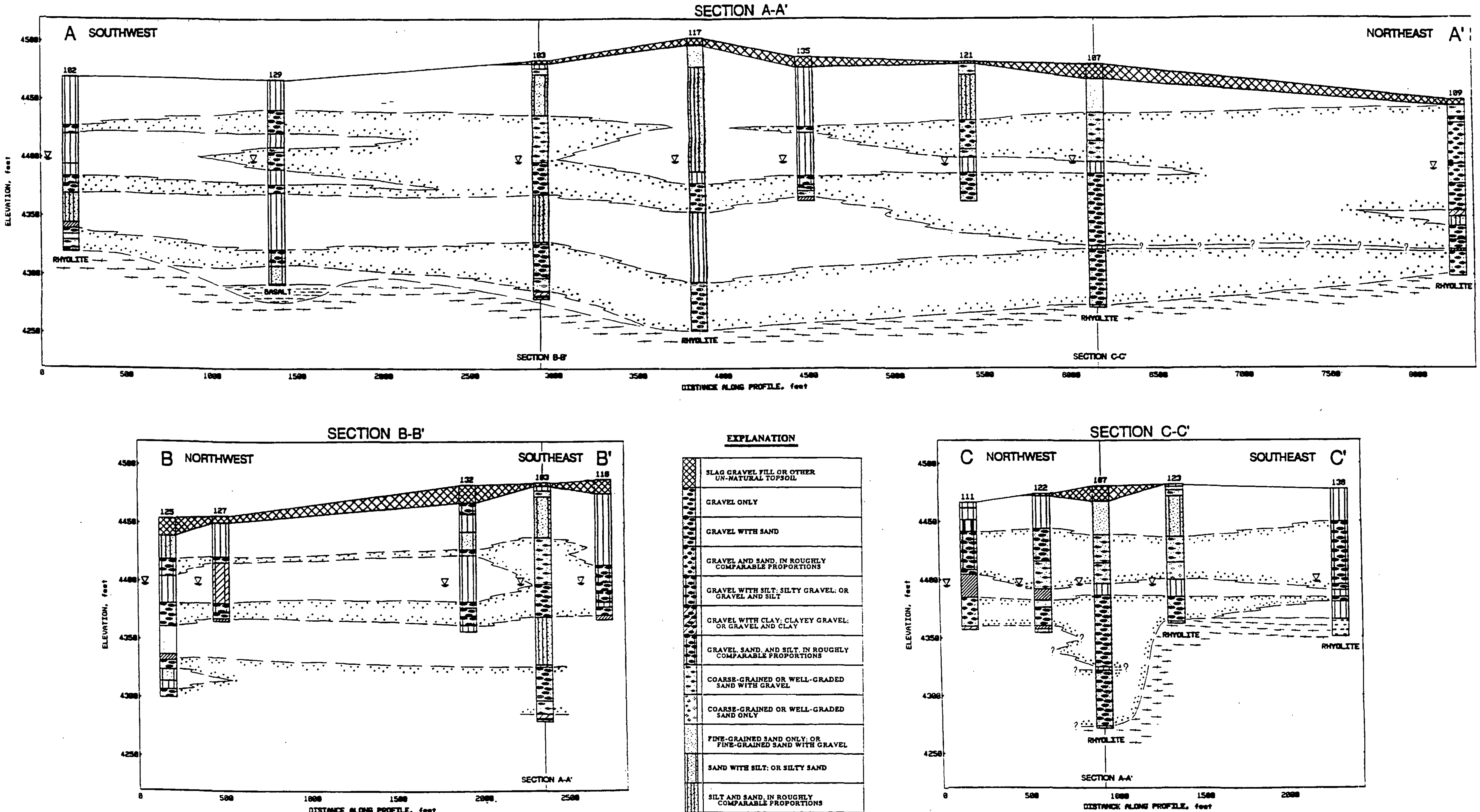
BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

FMC - POCATELLO

1990 SOIL BORINGS WITH SUBSURFACE PROFILE LOCATIONS

JOB No.	DRAWING No.	REV.
20906	FIGURE 3-8	

20906/1 4l/m/Pocatello/153l
5/26/92 l/jm:3



EXPLANATION

- SLAG GRAVEL FILL OR OTHER UN-NATURAL TOPSOIL
- GRAVEL ONLY
- GRAVEL WITH SAND
- GRAVEL AND SAND, IN ROUGHLY COMPARABLE PROPORTIONS
- GRAVEL WITH SILT; SILTY GRAVEL; OR GRAVEL AND SILT
- GRAVEL WITH CLAY; CLAYEY GRAVEL; OR GRAVEL AND CLAY
- GRAVEL, SAND, AND SILT, IN ROUGHLY COMPARABLE PROPORTIONS
- COARSE-GRAINED OR WELL-GRADED SAND WITH GRAVEL
- COARSE-GRAINED OR WELL-GRADED SAND ONLY
- FINE-GRAINED SAND ONLY; OR FINE-GRAINED SAND WITH GRAVEL
- SAND WITH SILT; OR SILTY SAND
- SILT AND SAND, IN ROUGHLY COMPARABLE PROPORTIONS
- SAND WITH CLAY; OR CLAYEY SAND
- SILT; OR SILT WITH GRAVEL, SAND, AND/OR CLAY
- SILT AND CLAY, IN ROUGHLY COMPARABLE PROPORTIONS
- CLAY; OR CLAY WITH GRAVEL, SAND, AND/OR SILT
- CALICHE
- RHYOLITE OR BASALT BEDROCK

Notes:

∇ Ground-water elevations as measured in well 12-1-90

Vertical exaggeration 6.7X

SOURCE: FMC, 1991

BECHTEL ENVIRONMENTAL, INC. SAN FRANCISCO	
EASTERN MICHAUD FLATS POCATELLO, IDAHO	
FMC FACILITY SUBSURFACE PROFILES	
JOB No. 21372	DRAWING No. FIGURE 3-9

143402

facility; and well-defined clay beds were identified in only a limited number of borings drilled on the FMC facility in 1990 as shown in subsurface profile C-C′ in Figure 3-9 (FMC, 1991b). Coarser deposits of, or contemporary to, the American Falls Lake Beds may exist beneath the FMC facility but are difficult to distinguish from the Sunbeam Formation. The areal extent of the American Falls lake beds is not well defined towards the Portneuf River and beneath the Simplot facility.

The Michaud Gravel, which consists of rounded gravel and boulders of mostly metamorphic lithologies, has been reported to exist beneath most of the EMF site (Ecology & Environment, 1988; Trimble, 1976; Jacobson, 1982, M-K, 1989). However, the Michaud Gravel becomes thin and/or discontinuous beneath most of the FMC facility except for extensive deposits beneath the northeast corner where the unit is either interbedded with, or truncates, the Sunbeam Formation (FMC, 1991b).

3.2.2 EMF Site Groundwater Hydrology

Groundwater hydrology of the EMF site is influenced by stratigraphic transitions that occur in this region where the Snake River Plain meets the rhyolite bedrock of the Bannock Range.

Based on the information collected at the FMC facility (FMC, 1991b), a relatively low permeable layer separates the shallow and deep water-bearing zones within the unconsolidated aquifer. This low permeability layer consists of silts and clays, and the thickness of the layer varies areally (see Figure 3-9). Underneath the central part of the FMC facility, the thickness of the layer is about 60 feet. In the northeastern part of the FMC facility the layer is non-existent or very thin (2 feet), thus resulting in one water-bearing unit within the unconsolidated aquifer.

Based on the available information, the presence of this relatively low permeability zone beneath the Simplot facility cannot be determined conclusively. As discussed in the regional geology section (Section 3.1), this area was subjected to a severe flood event that may have eroded the American Falls lake beds beneath the Simplot facility. For the development of this work plan, it was assumed that two higher permeability zones exist in the central part of the Simplot facility, and that one higher permeability zone exists in the northern part of the Simplot facility.

The aquifer beneath the FMC facility consists of alternating coarse-grained and fine-grained intervals. The fine-grained intervals do not appear to form laterally continuous layers and so would not prevent hydraulic communication between the relatively more-permeable saturated coarse-grained intervals. During pumping tests of the deeper coarse-grained interval, changes were observed in groundwater levels in the shallow coarse-grained interval, confirming hydraulic communication between the two intervals. Geologic information and aquifer test data also indicate that the single aquifer in unconsolidated sediments beneath the FMC facility is semi-confined beneath the western and central portions of the FMC facility and possibly unconfined beneath the northeastern portion of the FMC facility (FMC, 1991b). The locations of existing groundwater monitoring wells are shown in Figure 3-4, and construction details are summarized in Table 3-6.

Groundwater beneath the EMF site is believed to be recharged by percolation of local precipitation and storm runoff through unconsolidated deposits and rhyolite bedrock of the northern Bannock Range. Groundwater, possibly originating as infiltrated irrigation waters, may also enter the EMF site from the southwest. As the groundwater flows northward beneath the EMF site, some of the groundwater originating from the bedrock of the Bannock Range may enter the overlying unconsolidated deposits.

Groundwater flow in both the shallow and deep coarse-grained intervals of the shallow single aquifer beneath the FMC facility was determined to be toward the north-northeast as shown in the FMC facility groundwater elevations and contours, Figure 3-10 (FMC, 1991b). A comparison of groundwater elevations in paired wells indicates no significant vertical gradient between the shallow and deep coarse-grained intervals in the western and central portions of the FMC facility.

Groundwater flow beneath most of the Simplot facility has been reported to be towards the north to northeast in the shallow unconfined aquifer (PEI, 1985) and

Table 3-6
CONSTRUCTION DETAILS OF EXISTING WELLS

Well Identification Number	Elevation		Depth		Casing Diameter Material and Well Screen Information
	Top of Casing, msl	Ground Surface, msl	Top of Screen, bgs	Bottom of Screen, bgs	
101	4472.00	4470.05	87.0	97.0	4" Sch.40 PVC 0.020" slots
102	4471.68	4469.74	136.5	146.0	4" Sch.80 PVC 0.020" slots
103	4486.35	4484.68	178.4	198.5	4" Sch.80 PVC 0.020" slots
104	4486.71	4484.64	96.5	106.5	4" Sch.40 PVC 0.020" slots
106	4498.45	4496.50	125.0	135.0	4" Sch.40 PVC 0.020" slots
107	4482.46	4480.69	186.2	206.2	4" Sch.80 PVC 0.020" slots
108	4482.40	4480.25	97.6	107.6	4" Sch.40 PVC 0.020" slots
109	4451.31	4449.69	137.5	147.0	4" Sch.80 PVC 0.020" slots
110	4450.57	4449.28	85.0	95.0	4" Sch.40 PVC 0.020" slots
111	4468.04	4466.34	92.3	101.7	4" Sch.40 PVC 0.020" slots
112	4467.91	4466.00	87.8	97.2	4" Sch.40 PVC 0.020" slots
113	4462.97	4461.15	82.2	91.7	4" Sch.40 PVC 0.020" slots
114	4470.60	4468.61	116.7	126.2	4" Sch.40 PVC 0.020" slots
115	4469.73	4467.74	118.5	128.5	4" Sch.40 PVC 0.020" slots
116	4489.23	4487.12	106.6	116.1	4" Sch.40 PVC 0.020" slots
117	4505.76	4503.88	225.0	245.0	4" Sch.80 PVC 0.020" slots
118	4506.35	4504.28	128.0	138.0	4" Sch.40 PVC 0.020" slots
119	4508.89	4506.58	127.5	137.5	4" Sch.40 PVC 0.020" slots
120	4500.32	4498.33	118.7	128.2	4" Sch.40 PVC 0.020" slots
121	4485.58	4483.46	106.0	116.0	4" Sch.40 PVC 0.020" slots
122	4475.92	4473.90	101.5	111.5	4" Sch.40 PVC 0.020" slots
123	4484.12	4481.99	106.5	116.0	4" Sch.40 PVC 0.020" slots
124	4448.45	4446.62	72.6	82.1	4" Sch.40 PVC 0.020" slots
125	4455.77	4454.02	145.4	150.4	4" Sch.80 PVC 0.020" slots
126	4455.97	4454.00	75.5	85.5	4" Sch.40 PVC 0.020" slots
127	4458.20	4456.36	77.0	86.5	4" Sch.40 PVC 0.020" slots
128	4461.85	4459.97	84.3	93.8	4" Sch.40 PVC 0.020" slots
129	4469.69	4467.92	159.5	169.5	6" Sch.80 PVC 0.020" slots
130	4470.58	4468.49	166.5	176.5	4" Sch.80 PVC 0.020" slots
131	4485.95	4484.54	153.9	163.9	4" Sch.80 PVC 0.020" slots
132	4484.59	4482.69	106.4	115.9	4" Sch.40 PVC 0.020" slots
133	4479.50	4477.19	217.5	237.5	4" Sch.80 PVC 0.020" slots
134	4478.93	4477.00	102.5	112.0	4" Sch.40 PVC 0.020" slots
135	4489.14	4487.10	107.4	116.8	4" Sch.40 PVC 0.020" slots
136	4479.55	4477.61	112.5	122.5	4" Sch.40 PVC 0.020" slots
137	4471.13	4468.39	86.5	96.5	4" Sch.40 PVC 0.020" slots
FMC-1	4465.70	?	147	196	16" steel?, 16" perforated steel?
FMC-3	4450.65	?	155	202	16" steel?, 16" perforated steel?
FMC-4	4462.63	?	151	200	16" steel?, ?" open hole?
FMC-5	4446.62	?	100	216	16" steel?, 16" perforated steel?

Table 3-6 (Cont'd)

Well Identification Number	Elevation: Top of Casing, msl	Elevation: Ground Surface, msl	Depth: Top of Screen, bgs	Depth: Bottom of Screen, bgs	Casing Diameter Material and Well Screen Information
Frontier	?	4420	105.0	148.0	?
Kinport (Idaho Power)	4565.60	?	95.0	234.0	12" steel?
New Pilot House	?	4456	170.0	200.0	8" steel?
Old Pilot House	?	4455	81.0	103.0	8" steel?
PEI-1	?	4737.91	200.0	220.0	4" PVC,10-slot PVC
PEI-2	?	4568.96	143.0	163.0	4" PVC,10-slot PVC
PEI-3	?	4581.2	185.0	205.0	4" PVC,10-slot PVC
PEI-4	?	4411.32	28.0	48.0	4" PVC,10-slot PVC
PEI-5	?	4753.12	225.0	245.0	4" PVC,10-slot PVC
PEI-6	?	4411.9	25.0	45.0	4" PVC,10-slot PVC
SWP-4	?	4446	68.0	215.0	20" steel, ?" perforated steel
SWP-5	?	4448	90.0	248.0	20-16" steel, ?" perforated steel
SWP-6	?	4447	70.0	275.0	20" steel, perf. steel, open hole
TW2S	4472.29	?	97	110	6" steel, 4" 20-slot stainless
TW2I	4471.76	?	185	225	6" steel, 6" perforated steel
TW2D	4471.79	?	292	312	6" steel, 4" perforated steel
TW3S	4450.93	?	0	97	6" perforated steel
TW3D	4450.76	?	237	257	6"&4" steel, 3-7/8" open hole
TW4S	4462.02	?	76	84	6" steel, 4" 20-slot stainless
TW4I	4462.25	?	106	118	6" steel, 4" 20-slot stainless
TW4D	4462.12	?	157	200	6" steel, 4" perforated steel
TW5S	4475.15	?	96	100	6" steel, 4"? 20-slot stainless
TW5I	4475.07	?	133	140	6" steel, 4"? 20-slot stainless?
TW5D	4475.00	?	272	283	6" steel, 4" perforated steel?
TW9	4449.58	?	76	80	6" steel, 4"? 20-slot stainless?
TW10	4462.71	?	90	98	6" steel, 6"? 20-slot stainless
TW11S	4426.18	?	48	57	6" steel, 6"? 20-slot stainless
TW11I	4426.33	?	126	135	6" steel, 6-5/8" open hole
TW12	4436.26	?	54	62	6"? steel?, 6"? 20-slot stainless

Notes:

Elevations and depths are reported in feet.

msl = mean sea level

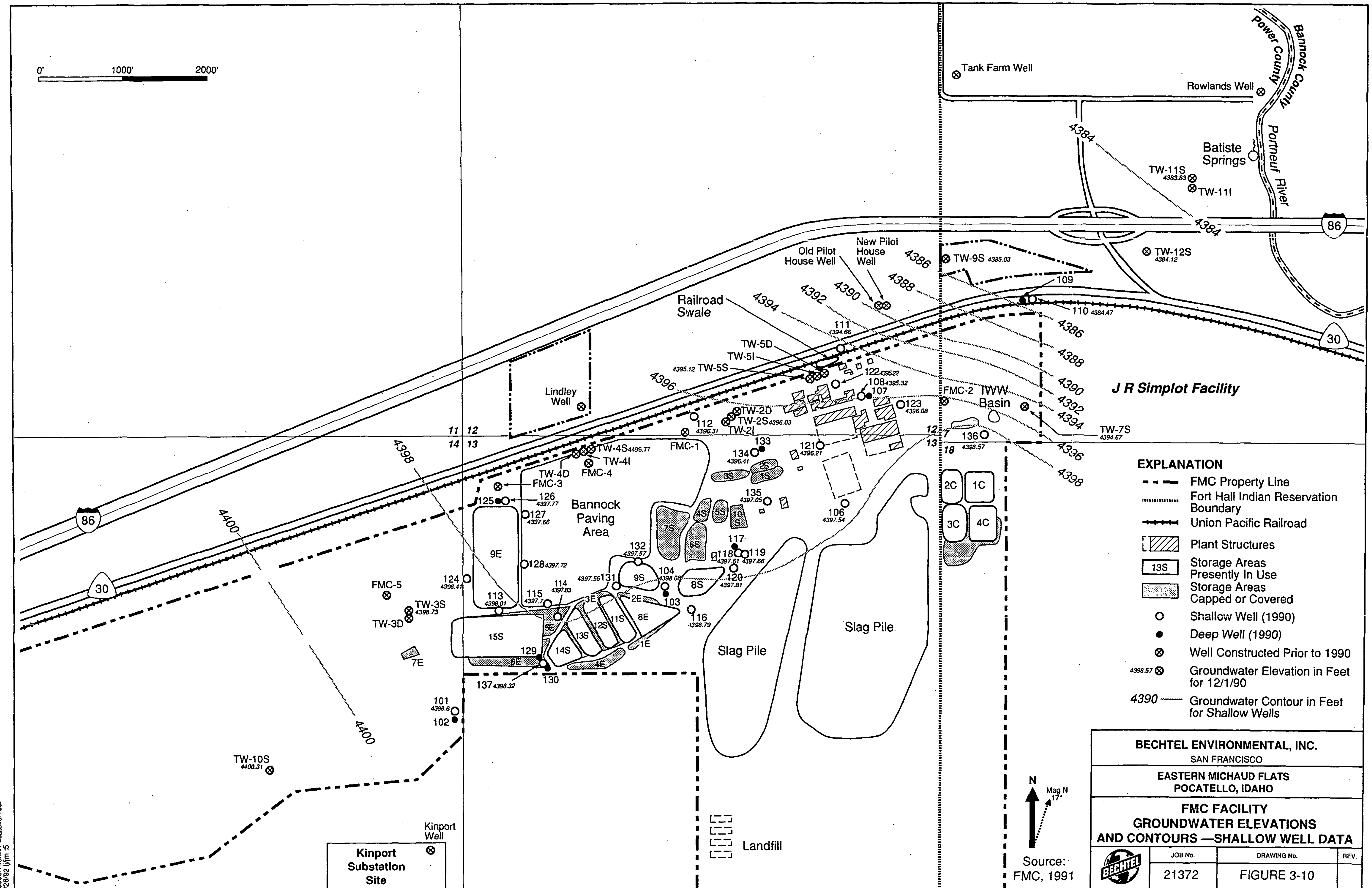
bgs = below ground surface

? = data unavailable or uncertain

Borings for wells 101 through 137 were 10 inches in diameter.

Wells 105, 138, and TW-6 were never constructed.

Wells FMC-2, TW-1, TW-7, TW-8 have been abandoned.



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towards the north to northwest in the deep aquifer (Ecology & Environment, 1988). Jacobson (1982) shows a cone of depression around the industrial plants with local groundwater moving toward the pumping wells. (The local direction of groundwater flow beneath the Simplot facility will be confirmed in the course of the RI/FS, after the installation of additional monitoring wells at the facility.)

Beneath the northern portion of the EMF site, the overall groundwater flow is towards the north. An upward gradient exists between the two water bearing intervals in the unconsolidated deposits in the region extending from the northeastern portion of the FMC facility to the Portneuf River.

3.2.3 EMF Site Surface Water Hydrology

The main surface water features at the EMF site are the Portneuf River and intermittent stream channels in the Bannock Range. The Portneuf River is a perennial stream that flows toward the northwest near the northeastern boundary of the Simplot facility. The Bannock Range is incised with intermittent stream channels in exposed, or loess-covered, bedrock. In the vicinity of the EMF site, the largest of these intermittent stream channels is Michaud Creek. The areas of the EMF site north of the FMC and Simplot facilities are flat-lying farmlands with no discernable surface water drainage pattern.

The Flood Insurance Rate Map (FIRM) for the Portneuf River, published by the Federal Emergency Management Agency (FEMA, 1979a&b) was consulted to evaluate the location of the FMC and Simplot facilities with respect to the 100-year floodplain of the Portneuf River. The facilities are not in the 100-year flood plain of the Portneuf River.

Surface water features on the FMC facility include ephemeral stream channels that originate upgradient on the slopes of the Bannock Range. Most of the storm run-off from the FMC facility process areas is diverted to channels that terminate at the railroad swale located along the northern FMC facility boundary. The run-off percolates into the slag and unconsolidated sediments underlying the railroad swale. Stormwater run-off is not discharged to the river.

Stormwater run-off from the Simplot facility is collected by a series of plant drains which discharge to the water treatment ponds. Some plant stormwater run-off is collected by the east overflow pond. Run-off is not discharged to the river.

3.3 PREVIOUS SITE INVESTIGATIONS

This section summarizes previous site investigations that have been conducted at the FMC and/or Simplot facilities. The results and conclusions of these previous investigations are preliminary and will be augmented by data collected in the course of the EMF site RI.

3.3.1 EMF Site Investigations

As previously stated, the USGS prepared an EIS in 1977 to address the development of phosphate resources in southeast Idaho. The EIS attributed relatively high levels of phosphate (0.35 to 7.5 parts per million), detected in samples from Batiste Springs, to discharges to the Portneuf River from the FMC and Simplot phosphate ore processing facilities (Ecology & Environment, 1988).

From 1980 through 1989, the USGS conducted groundwater monitoring studies to assess water quality in the Eastern Michaud Flats area (Jacobson, 1982, 1984, 1989). The USGS reported that several wells drawing water from the shallow unit of the groundwater system contain elevated levels of arsenic. The groundwater samples collected from the deeper unit indicated no elevated levels of inorganics.

Ecology & Environment (E&E) conducted file reviews and site inspections of the FMC and Simplot facilities in 1987 while under contract to the EPA to evaluate the extent of groundwater contamination and to identify potential sources. E&E's study included a geophysical survey to assess the extent of potential groundwater contaminant plumes, and collection of 24 groundwater, 1 spring-water, 14 waste pond water, 13 waste pond sediment, 2 waste pile, and 2 soil samples from selected locations at both facilities.

The following are E&E's findings (E&E, 1988):

- Elevated levels of cadmium, chloride, total chromium, copper, fluoride, selenium, silica, and/or sodium were detected in waste pond and drainage ditch sediment samples collected from both facilities, and elevated levels of chloride and fluoride in gypsum solids samples collected from the Simplot facility.
- Water-bearing intervals underlying the FMC and Simplot facilities contain metals at concentrations exceeding federal drinking water standards, and unlined ponds at the facilities are possible sources of contamination.
- The geophysical surveys and the elevated levels of arsenic in certain wells appeared to delineate a potential contaminant plume in the shallow water-bearing interval northeast of the FMC facility.

The Eastern Michaud Flats site, which includes both the Simplot and FMC facilities, was placed on the NPL on the basis of E&E's findings.

3.3.2 FMC Facility Investigations

The installation of production wells and drilling of soil borings for foundation studies provided limited information on subsurface geological conditions at the FMC facility.

From 1971 to 1979, FMC contracted Geraghty and Miller, Inc. (G&M) to review groundwater analytical data of samples collected from FMC onsite wells, offsite wells, and nearby springs to determine the effect of FMC's operations on groundwater quality. From August 1980 through November 1981, G&M, again under contract to FMC, installed 19 monitoring wells and collected groundwater samples at quarterly intervals to evaluate groundwater quality at the site. G&M reported elevated total dissolved solids concentrations extending from Pond 7E to the Portneuf River as well as a smaller warm water plume suspected of being caused by the slag operation. G&M concluded that the TDS plume followed the groundwater flow and discharged into the Portneuf River through a series of small springs on the west bank of the Portneuf River (Geraghty and Miller, 1982a&b).

An FMC facility assessment was conducted from September to December 1990 to evaluate the nature and extent of contamination at the facility, if any (FMC, 1991b). The facility assessment further characterized the hydrogeologic conditions and established a groundwater monitoring program fulfilling RCRA requirements. The field investigation conducted in 1990 included collection of one round of groundwater samples, surface soil samples, and subsurface soil samples.

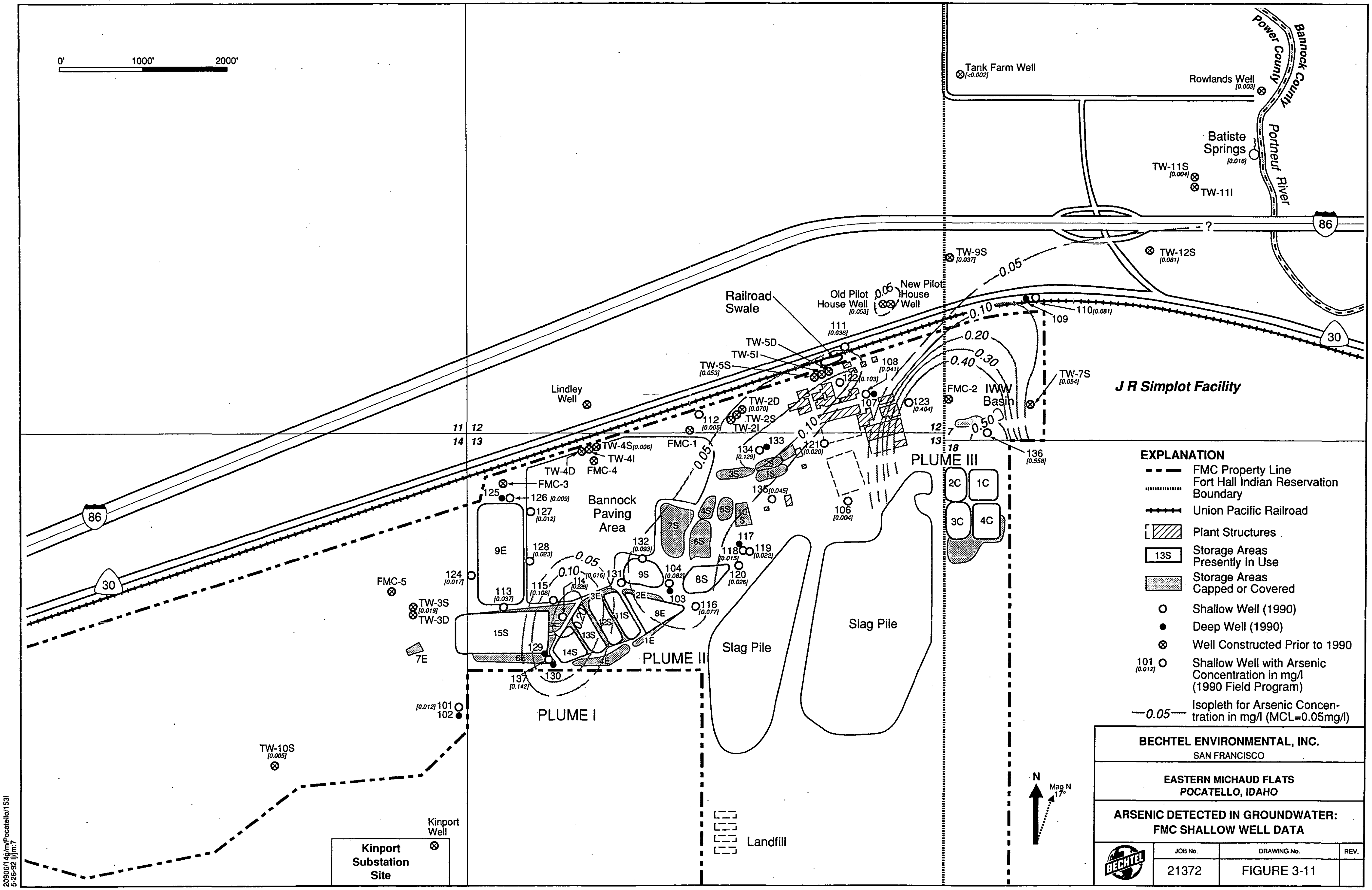
The FMC facility assessment findings are summarized below.

3.3.2.1 Groundwater Investigation

Sixty-seven groundwater samples were collected from 64 sampling points during the 1990 field program. Sampling points included 36 newly installed wells, 16 existing test wells, five FMC production wells, selected domestic wells in Eastern Michaud Flats, and Batiste Springs. (See Figure 3-4.)

Three areas of possible groundwater contamination were identified within the FMC facility boundary. The chemical analyses of the water samples indicate that three dissolved constituents (arsenic, nitrate and selenium) exceed their respective primary maximum contaminant levels (MCLs) in a number of samples collected from several on-site wells and from some shallow offsite wells downgradient of the facility boundary. Isopleths for these three chemicals based on a single round of groundwater samples collected in the Fall of 1990 are shown in Figures 3-11 through 3-13.

An area of elevated arsenic levels was identified in the shallow, unconsolidated water-bearing interval beneath the western portion of the facility. This area is located beneath both active and inactive evaporation and settling ponds. Elevated levels of nitrate in groundwater were also found in the shallow water-bearing



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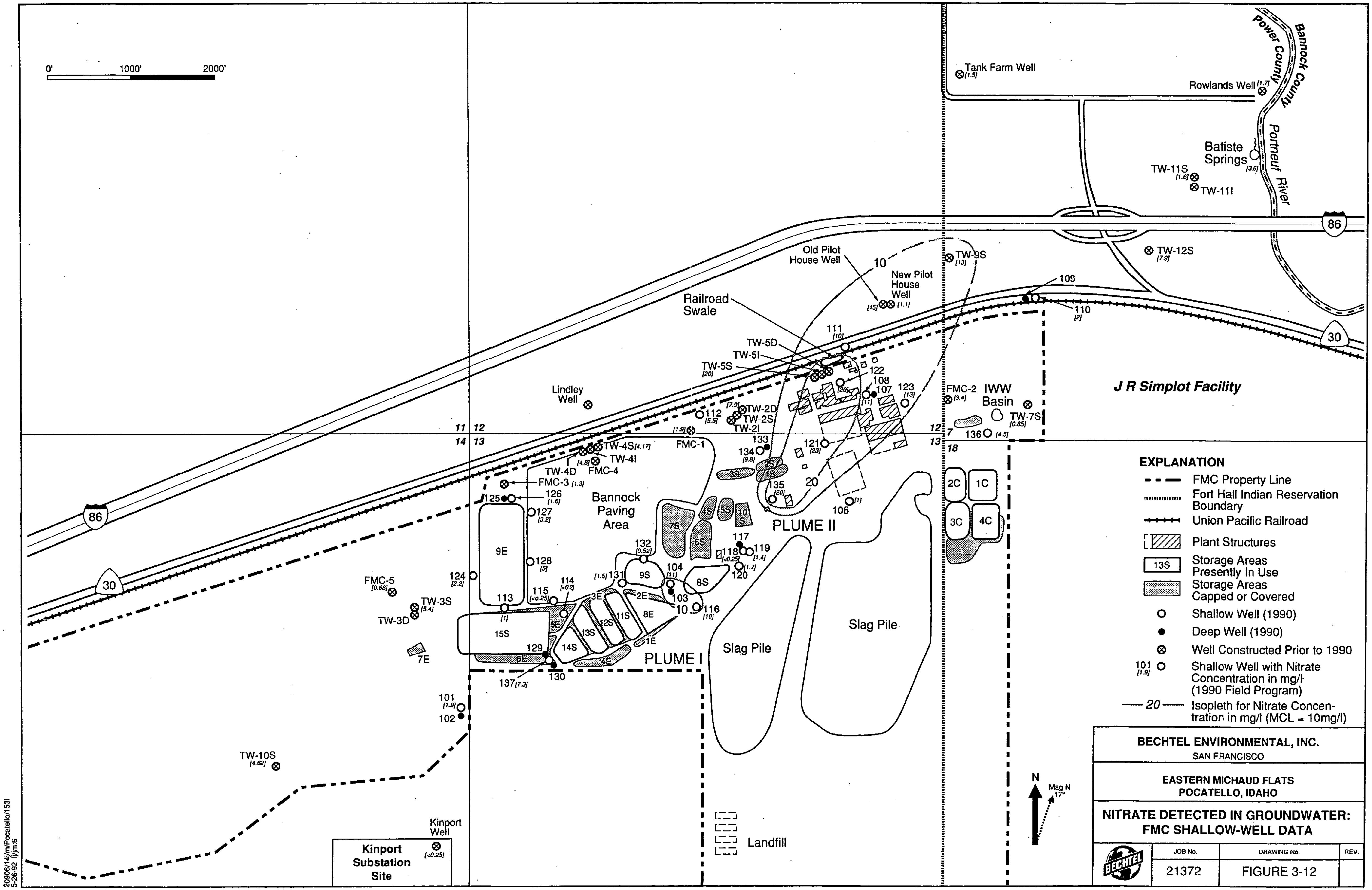

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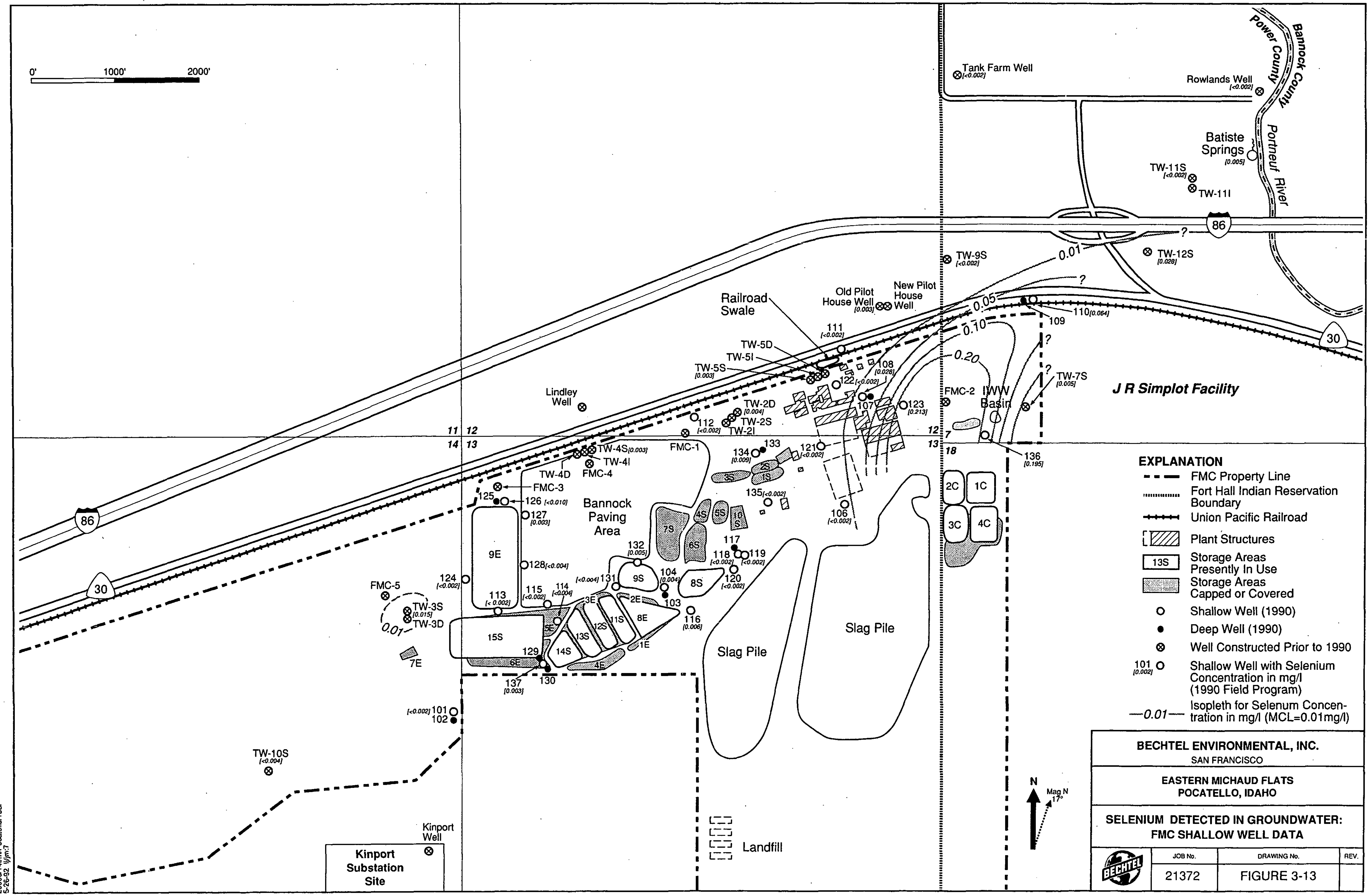

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interval, but within the central portion of the FMC facility. Elevated levels of both arsenic and selenium were found in the eastern portion of the FMC facility in the shallow water-bearing interval.

The following dissolved constituents (arsenic, iron, lead, manganese, potassium, sodium, selenium, alkalinity, chloride, fluoride, nitrate, sulfate, total dissolved solids, total phosphorus, and orthophosphate) were detected in groundwater beneath the FMC facility at levels higher than the background levels characteristic of the area. These constituents are present at elevated levels (above background) in the shallow, saturated, coarse-grained interval beneath the facility. Comparison of chemical analyses of samples taken from different depth intervals of the aquifer indicates that the elevated levels are restricted to the uppermost (shallow) interval.

Surface source areas for the elevated levels of inorganic parameters detected in groundwater have not been completely determined or understood. These elevated levels in groundwater could be the remnants of an historical groundwater degradation that occurred when unlined, currently inactive ponds were in use. This will be evaluated by investigations described in Section 6 of this Work Plan. Prior to decommissioning of the unlined ponds at FMC, Batiste Springs was reported to have high levels of inorganic compounds (Geraghty and Miller, 1982b). In general, elevated levels of inorganic compounds were not found in samples collected from sampling points downgradient of the FMC facility (Batiste Springs, Old Pilot House, New Pilot House, Rowlands Well) during the Fall 1990 sampling round. Average arsenic and chloride concentrations from these downgradient sampling points for samples collected in the Fall 1990 sampling round are lower than levels detected between 1973 and 1982 (Geraghty and Miller, 1982b) for these same constituents. A summary of arsenic and chloride concentrations reported by Geraghty and Miller and those detected in the FFA is provided in Table 3-7.

Table 3-7
ARSENIC AND CHLORIDE DATA[a]
GERAGHTY AND MILLER 1982 VS FMC 1990

Arsenic Concentration

Well ID	1990 (mg/l)	Pre-1982 (mg/l) Minimum	Pre-1982 (mg/l) Maximum	Pre-1982 (mg/l) Average
Old Pilot House	0.0527	0.007	0.250	0.1528
New Pilot House	0.0025	0.001	0.008	0.0042
Batiste Spring	0.0158	0.002	0.028	0.015
Rowlands	0.0026	0.002	0.008	0.0048

Chloride Concentration

Well ID	1990 (mg/l)	Pre-1982 (mg/l) Minimum	Pre-1982 (mg/l) Maximum	Pre-1982 (mg/l) Average
Old Pilot House	245	104	520	281.1
New Pilot House	30	27	130	41.2
Batiste Spring	45	52	170	93.6
Rowlands	21	22	54	31.8

Note:
(a) Downgradient sampling points only.

3.3.2.2 Soil Investigation

A total of 12 surface soil (sample interval = 0 to 0.5 feet) and 105 subsurface soil samples were collected throughout the FMC facility. Nine parameters (cadmium, chromium, lead, silver, vanadium, zinc, fluoride, total phosphorus, and orthophosphate) were most frequently and consistently detected at elevated concentrations (above background) in samples collected from surface soils.

Elevated concentrations (above background) of arsenic, cadmium, zinc, fluoride, orthophosphate, and total phosphorus were detected in subsurface soil samples collected near old and new pond areas. Concentrations of zinc, fluoride, total phosphorus, and orthophosphate were one to two orders of magnitude above background concentrations in shallow subsurface soil samples collected from Pond 1E, Area 9S, and the Bannock Paving Area. The soil samples collected at ponds 1E and 9S were not soil samples and consisted of precipitator dust.

3.3.3 Simplot Facility Investigations

In 1984, the EPA contracted with PedCo Environmental, Inc. (PEI) to evaluate the waste management practices of phosphate ore processing plants across the nation.

As part of this contract, six monitoring wells were installed at the Simplot facility. (See PEI wells 1 through 6 on Figure 3-4.) Analytical results for groundwater samples collected from the Simplot wells during the PEI investigation indicated that arsenic concentrations ranged from less than 0.001 to 0.7 mg/l and cadmium concentrations ranged from less than 0.001 to 0.028 mg/l. Low concentrations of barium, chromium, lead, vanadium, and zinc were also detected in the groundwater samples (PEI, 1985). Since PEI's installation of the groundwater monitoring wells, Simplot has continued to collect and analyze samples from these wells on a quarterly basis. Analytical data indicate that groundwater in the shallow, unconfined water-bearing zone directly downgradient of the original gypsum stack and in the deep unconfined water-bearing zone directly downgradient of the newer gypsum stack is generally of lesser quality than the upgradient groundwater in the deep, unconfined water-bearing zone. Concentrations of arsenic have routinely exceeded the primary MCL in samples from Well PEI-3. Sulfate concentrations in samples from Well PEI-3 are at the solubility limit and are comparable to concentrations in the gypsum liquid discharged to the stack. The high sulfate concentrations in Well PEI-3, along with the fact that Well PEI-3 is routinely pumped dry prior to sampling, suggests that PEI-3 may be completed in a saturated zone above the actual water table. A summary of Simplot quarterly sampling data is provided in Appendix B.

The solubility limit for calcium sulfate dihydrate (natural gypsum) in cold water is 2410 mg/l (CRC, 1980). The average concentrations of calcium and sulfate in samples from PEI-3 are 488 mg/l and 2303 mg/l, respectively (see Appendix B).

4. Initial Site Evaluation

Section 4

Initial Site Evaluation

This section presents a preliminary conceptual model of the EMF site. The conceptual site model identifies potential contaminant sources and associated migration pathways and receptors. This section also presents the rationale for waste types and/or waste disposal units not included in the EMF conceptual site model. Preliminary remedial action objectives/actions/technologies, operable units, and ARARs are also described.

The conceptual model represents the initial site evaluation/characterization, and is based on existing data for the FMC and Simplot facilities as well as data developed in the FMC Facilities Assessment (FFA). The conceptual model represents a working hypothesis which will be refined as data are collected from the investigation programs described in Section 6 of this Work Plan. The model has been developed to identify and describe potential source areas; to develop a framework for evaluating data related to these source areas and any impacts they may have had on the air, soil, and groundwater in and adjacent to the EMF Site; and to assist in the development of appropriate cost-effective remedial actions, should they be required.

4.1 EMF CONCEPTUAL SITE MODEL

A conceptual model of the EMF site is presented in Figure 4-1. The model was developed from information on processes and operations at the FMC and Simplot facilities as well as from data collected in previous investigations. The model identifies potential sources of contamination, release mechanisms, migration pathways, and receptors.

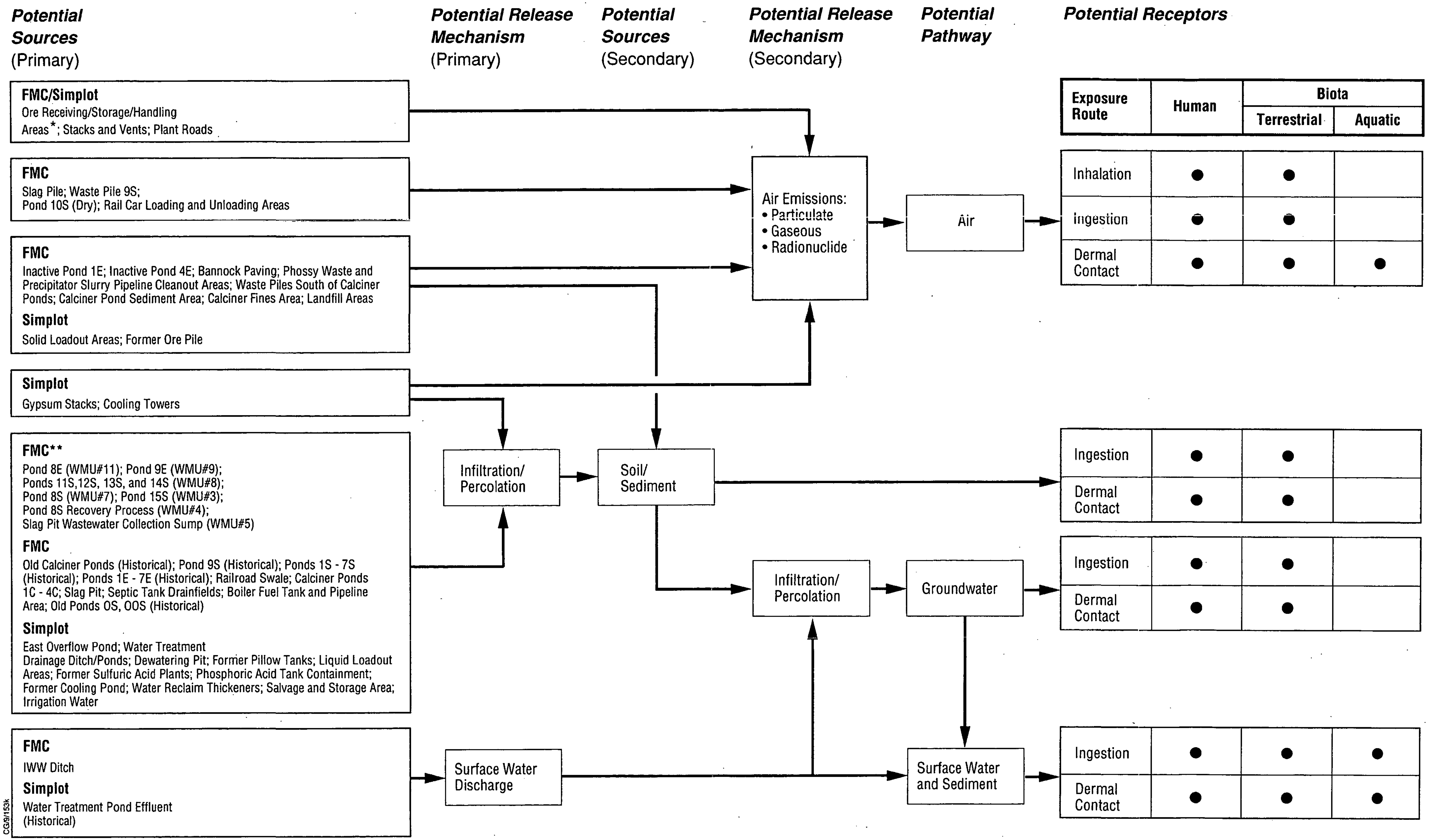
The potential sources listed in Figure 4-1 may affect or have previously affected one or more of three major potential migration pathways. Some of the potential sources may release gaseous or particulate emissions which are transported downwind of the two facilities via the air pathway. Some of these same potential sources and others may affect and/or have affected the groundwater pathway via the infiltration/percolation of contaminated fluids through subsurface materials. Other potential sources may affect and/or have affected the surface water pathway and associated sediments.

The potential sources listed in Figure 4-1 include those materials and facilities described in Sections 2.3 and 2.4 which have potential for releasing contaminants to the environment. All of the potential sources identified in Figure 4-1 may be sources of one or more of many inorganic constituents originating from and occurring naturally in the phosphate ore. These constituents include phosphate; elements such as arsenic, chromium, zinc, cadmium, and lead; and selected radionuclides. In addition to the naturally-occurring ore constituents, process intermediates may also be present in some facility wastes (e.g., ammonia in Simplot's water treatment pond influent).

4.1.1 Potential Sources of Air Contamination

Potential sources of air contamination include particulate and gaseous emissions, both point source and fugitive, from the FMC and Simplot facilities. Emissions originate from various sources such as ore receiving, storage, and handling operations; plant stacks and vents; loadout areas; plant roads; and, in the case of the FMC facility, some inactive ponds. The gypsum stacks at the Simplot facility and slag pile at the FMC facility may also be a source of air emissions. As of September 1991, ore is now transported to the Simplot facility in slurry form. Therefore, Simplot ore receiving, storage, and handling are no longer potential sources of particulates. In addition, Simplot has eliminated its calciners as described in Section 2.4.1.4.

Particulate and gaseous emissions are included in the conceptual model because they may contain potential contaminants (e.g., heavy metals, etc.) not specifically addressed by existing permits/rules. Radionuclide emissions have been the subject of extensive studies performed to support the December 15, 1989 final rule on National Emissions Standards for Hazardous Air Pollutants (NESHAPs) under Section 112 of the Clean Air Act. The rule specifically regulates polonium-210 emissions to ambient air from all elemental phosphorus plant calciners and nodulizing kilns, and radon-222 emissions into the air from phosphogypsum. Radionuclide emissions are included in the conceptual model for the purposes of evaluating these emissions as potential sources.



* As of September 1991, ore is transported to the Simplot facility in slurry form. Simplot ore receiving, storage, and handling is no longer a potential source of particulates.

** FMC has submitted a RCRA Part B application to the EPA which addresses management of these units.

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Figure 4-1 EMF Conceptual Site Model

Offsite slag is not addressed in the conceptual model. It is excluded based on a position outlined in a letter dated October 29, 1990, from William K. Reilly, the EPA Administrator, to J. McClure, U.S. Senator for the State of Idaho (Reilly, 1990). The letter stated that the issue of offsite radioactive slag waste originating from the FMC facility will be handled outside the Superfund NPL remedial process.

4.1.2 Potential Sources of Groundwater Contamination

Potential sources of groundwater contamination include various active or inactive ponds at the FMC and Simplot facilities which contain(ed) and/or routinely receive(d) contaminated water as well as leakage or spillage in operating plant areas. Additionally, contaminated soil may constitute a secondary source of contamination.

Potential sources of groundwater contamination at the FMC facility include the following lined ponds: Pond 8E, Pond 9E, Ponds 11S to 14S, Pond 15S, and Calciner Ponds 1C to 4C. Ponds 8E, 9E, and 15S are active RCRA units with double liners and leachate collection systems and have RCRA-required monitoring wells. Ponds 11S to 14S are RCRA units with required monitoring wells. Calciner Ponds 1C to 4C are double-lined ponds with leachate collection systems.

Potential sources of groundwater contamination also include Pond 8S, the slag pit, the slag pile, and the railroad swale. Historical sources of groundwater contamination at the FMC facility are: Old Calciner Ponds, Pond 9S, Ponds 1S to 7S, and Ponds 1E to 7E. In addition, process areas, storage areas, precipitator slurry and phossy water pipelines, rail car loading and unloading areas, and the sanitary drainfields could potentially contribute to groundwater contamination. Specific process or storage areas are included in the conceptual site model (Figure 4-1) and further described in Section 6.1 where plans for characterization of these potential sources are described.

The inactive ponds (historical sources) previously used by FMC to collect phosphorus-containing water were unlined and may contribute to the elevated levels of arsenic and selenium now observed in the groundwater beneath the FMC facility. These ponds no longer receive or contain process water. Some of the inactive ponds are now located underneath active lined ponds.

Potential sources of groundwater contamination at the Simplot facility include the gypsum stacks, east overflow pond, and water treatment ponds/dewatering pit. Water in these ponds/pit may percolate or have percolated through the subsurface to groundwater. Additional sources may include product loadout areas, plant cooling towers, and water reclaim thickeners, in which products are spilled or from which contact waters leak, and other plant operations or areas where spillage and/or leakage are known to have occurred. Specific operations or areas which fall into this latter category are included in the conceptual site model depicted in Figure 4-1 and further described in Section 6.1 where plans for characterization of these potential sources are described.

Because the Portneuf River is believed to be locally recharged by groundwater, these potential FMC and Simplot sources may now and/or in the future indirectly impact surface water. The impact on the Portneuf River will be further evaluated during these investigations.

4.1.3 Potential Sources of Surface Water and Sediment Contamination

FMC's IWW ditch which discharges non-contact cooling water to the Portneuf River may be a potential source of surface water contamination. Simplot's nutrient rich irrigation water, which was discharged to the Portneuf prior to July 1980, may have been a historical source of surface water contamination. Its impact, if any, on surface water can no longer be ascertained. At this time, evidence of its impact might only be found in river sediments.

4.1.4 Potential Exposure Pathways

The following possible routes of exposure have been identified: inhalation of, ingestion of, and/or dermal contact with particulates; and ingestion of and/or dermal contact with contaminated groundwater, surface water, and sediments.

Additional potential exposure pathways include inhalation of gaseous particulate and radioactive air emissions, and direct contact with surficial materials.

4.1.5 Potential Receptors

Potential receptors include area residents, site workers and visitors, and terrestrial and aquatic species in the vicinity of the facilities. More specifically, these receptors may include human and other terrestrial life downwind of the facilities, groundwater and surface water users downgradient of the two facilities, and terrestrial and aquatic species affected by changes in the Portneuf River and associated springs.

As part of the development of the NESHAPs for Radionuclides, EPA estimated the population within 1.6 and 2.5 miles is 160 and 2132 people, respectively, not including site workers and/or visitors (EPA, 1989a).

The population of Pocatello is listed at 46,080 in the 1990 Census, and the population of Chubbuck is estimated at 8000, according to the City of Chubbuck.

4.2 WASTE DISPOSAL UNITS AND RELEASES NOT INCLUDED IN THE CONCEPTUAL MODEL

Several waste management units (WMUs) described in Sections 2.3 and 2.4 are not included in the EMF conceptual site model since existing data on these WMUs support their exclusion from further investigation. However, this proposal is preliminary; data developed during the investigations described in Section 6.1 will be used to evaluate the validity of these exclusions. If data indicate that any of these WMUs are or may be sources of contamination, the conceptual model will be revised to include them.

The WMUs excluded from the conceptual model and the rationale for their exclusion are described below. Brief summaries of existing data are also presented where appropriate.

4.2.1 FMC Facility

Although it is unlikely that any of FMC's 13 WMUs (including the planned WMU) are currently sources of contamination, they were originally included in the evaluation of potential sources along with all other sources identified in the EMF conceptual site model. Eight of FMC's 13 WMUs have been identified in the conceptual site model as potential sources of contamination as appropriate to air or to groundwater (see Section 4.1). This is primarily because they are located in areas of previous potential sources (i.e., old unlined ponds). The remaining five WMUs excluded from the EMF conceptual site model are (see Figure 2-5):

- WMU#1 Drum storage area
- WMU#2 Andersen filter media storage area
- WMU#10 Phossy water surface impoundment (Pond 16S – not yet constructed)
- WMU#12 Scrubber blowdown wastewater treatment unit
- WMU#13 Andersen filter media treatment unit

A brief summary of existing data for each of these units is presented below (FMC, 1991a).

- WMU#1 – Drum Storage Area. The drum storage area, established in March 1990, is not considered a potential source of contamination because materials do not have the potential to migrate to any of the migration pathways (soil, air, groundwater, and surface water) identified in the conceptual site model. Constituents stored in the drum storage area are unlikely to migrate to groundwater because the area is paved and there is no driving force to groundwater given the low precipitation characteristic of the area. There have been no CERCLA reportable spills, and there is no evidence of spills or leaks out of the containment area. Weekly inspections performed by FMC personnel for RCRA compliance allow for the early identification of leaks and/or spills should they occur. In addition, spent solvents stored in the drum storage area are disposed of off site at a permitted hazardous waste disposal facility.

  Waste laboratory solvents, paint solvents, and degreasing solvents were sampled from drums located in the drum storage area. Three samples (one from each solvent type) were collected in November 1989.

The laboratory solvent sample was analyzed by the EP toxicity test for eight RCRA metals. It was also analyzed for corrosivity, ignitability, and reactivity. The paint and degreasing solvents were analyzed for F-listed wastes, which included base/neutral/acids, and semivolatile organics.

The laboratory solvent sample exhibited the characteristic of ignitability with a flash point of 104°F. None of the toxicity characteristic (TC) limits for metals were exceeded in this sample.

The paint solvent sample contained detectable amounts of methyl ethyl ketone (MEK), toluene, ethylbenzene, and xylenes.

The degreasing solvent samples contained detectable amounts of methylene chloride, 1,1,1-trichloroethane, toluene, tetrachloroethene, ethylbenzene, and xylenes.

- <u>WMU #2 – Andersen Filter Media Storage Area.</u> This storage area was established in March 1990. Anderson filter media is stored in bins and lined 20-cubic-yard gondolas in a secure area until it is shipped off site. There is no evidence that spills have occurred that may be contributing to soil or groundwater contamination in this area. Therefore, this storage area is not included in the conceptual site model.

  Samples of used Andersen filter media have been collected from the furnaces, phos dock, and Pond 8S recovery process while the units were operating. Andersen filter media samples were collected from the phos dock and the Pond 8S recovery process in June 1990. Filter media samples were collected from the furnace building scrubbers and the phos dock scrubbers in November 1990.

  The samples were analyzed using the TCLP leach test. Concentrations of cadmium and arsenic in excess of the TC regulatory limits were detected in the TCLP extracts. The cadmium concentrations in the extracts ranged from 0.47 to 42 mg/l, while the arsenic concentrations ranged from 0.3 to 26 mg/l. Thus, spent Andersen filter media was considered hazardous waste. In late 1991, a treatment unit for the Anderson filter media was installed. After treatment, the waste is no longer hazardous.

- <u>WMU#10 – Phossy Water Surface Impoundment Pond (Pond 16S).</u> Pond 16S has not yet been constructed. The construction plans include installation of double liners and a leachate collection system.

- <u>WMU#12 – Scrubber Blowdown Wastewater Treatment Unit</u>. The furnace Medusa scrubber blowdown wastewater treatment unit was constructed in 1987. The unit is surrounded by a secondary concrete containment, lined with a compatible sealant. Scrubber blowdown from the wastewater treatment unit is ultimately routed to the calciner ponds which have been identified as a potential source of groundwater contamination in the EMF conceptual site model (see Section 4.1). The wastewater treatment unit itself is a concrete-lined structure, and there is no evidence of spills or leaks from this unit.

Eight samples were collected and analyzed for RCRA metals and tested for corrosivity and ignitability. Two samples were collected in November 1989 from the second floor of the furnace building and subjected to the EP toxicity test and extracts analyzed for metals. Six additional samples were collected in September 1990 from the second floor of the furnace building where the wastewater exits from each scrubber.

Six of the eight samples exceeded the TC limit for cadmium. Cadmium concentrations ranged from 0.2 to 5.2 mg/l, with an average concentration of 2.52 mg/l. None of the other metals were detected at concentrations above the TC limits. Additionally, none of the samples exhibited the hazardous characteristics of corrosivity or ignitability.

- WMU #13 - Andersen Filter Media Treatment (Washing) Unit. The Andersen filter media treatment (washing) unit was installed in the summer of 1991. It is located on the 16-foot level (2nd floor) in the furnace building. The filter media and unit are located in containment berms to prevent loss of any material from spills or leaks. The unit and the area are washed down after each shift, and the wash water is pumped to the lime treatment unit. As an added containment measure, the unit's enclosed washing section is located within the furnace building.

  The Andersen filter media treatment (washing) unit uses hot (greater than 150°F) IWW to wash the filter media. This removes the fine particulates containing the heavy metals. The washed filter media are then dewatered to minimize the amount of contaminated water remaining in the filter media itself.

  This process lowers heavy metals concentrations to below their TCLP maximum contaminant limit. The wash water (rinsate) from the treatment unit is drained to the furnace Medusa tank and then pumped with the Medusa scrubber blowdown to the scrubber blowdown wastewater treatment unit (WMU #12) for lime treatment. The washed filter roll is removed from the treatment unit and stored temporarily in a bin. The washed Andersen filter media are currently being shipped to the USPCI TSD facility in Utah.

The wash water from the unit is treated in the wastewater treatment unit and ultimately discharged to the calciner ponds, which are identified as a potential source of groundwater contamination in the EMF conceptual model. The Andersen filter media treatment unit is fully contained and there is no evidence of spills or leaks from the unit. Therefore, it is not included in the conceptual model.

4.2.2 Simplot Facility

The only waste type or waste disposal unit not included in the EMF conceptual site model is:

- Landfills. Simplot landfills were used solely for the disposal of construction wastes, demolition rubbish, neutralized wastes, and general office waste and garbage. For this reason, they have not been identified as potential sources of contamination. Monitoring wells installed around the gypsum stacks will be located such that any leachate migrating from the landfills would be detected in samples from the wells.

4.3 PRELIMINARY REMEDIAL ACTION OBJECTIVES/ALTERNATIVES

The purpose of this section is to provide preliminary identification of potential remedial action objectives and alternatives for the EMF site, based upon the preliminary assessment of contamination and the conceptual model introduced in Section 4.1. It must be noted that this scoping phase is too early in the RI/FS process to permit detailed investigation of alternatives. Rather, the identification of preliminary remedial objectives and potential remedial technologies at this stage is required to help ensure that the data needed for the ultimate evaluation will be collected early in the field investigation effort.

The methodology consists of identification of potential remedial action objectives for each contaminated medium, followed by selection of a preliminary range of broadly defined remedial action alternatives and associated technologies. This process can only begin once a conceptual site model has been developed. The preliminary identification of remedial actions during the RI/FS scoping phase helps allow for the initial identification of ARARs expected to apply to site characterization and site remediation activities, and also helps focus planning efforts on subsequent data gathering requirements.

4.3.1 Preliminary Remedial Action Objectives

Remedial action objectives generally consist of medium-specific goals (i.e., goals for soil, groundwater, surface water, etc.) which are developed to protect public health, welfare and the environment from negative impacts associated with exposure to hazardous substances, pollutants or contaminants. Remedial action objectives may also be specific to the particular operable unit(s) associated with the site. In any event, these objectives must be developed based on knowledge of the nature and extent of contamination, contaminated media, exposure pathways, risk, and ARARs specific to the site. Preliminary remedial action objectives for potentially contaminated media at the EMF site are listed below.

Preliminary remedial action objectives for soils/sediments are to:

- Prevent the potential for ingestion of, and/or dermal contact with, contaminated soils/sediments having greater than 10^{-4} to 10^{-6} excess cancer risk or having a hazard index greater than 1.0 for noncarcinogenic risk, and/or in excess of chemical-specific ARARs.
- Prevent the potential for inhalation of contaminants having greater than 10^{-4} to 10^{-6} excess cancer risk, or having a hazard index greater than 1.0 for noncarcinogenic risk and/or in excess of chemical-specific ARARS.
- Prevent the potential for migration of soil/sediment contaminants in excess of chemical specific ARARs.

Preliminary remedial action objectives for groundwater are to:

- Prevent the potential for ingestion of groundwater containing contaminants having greater than 10^{-4} to 10^{-6} excess cancer risk, or having a hazard index greater than 1.0 for noncarcinogenic risk and/or in excess of chemical-specific ARARs.
- Prevent the potential for further migration of contaminated groundwater in excess of chemical-specific ARARs.

Preliminary remedial action objectives for surface water and sediments may include:

- Prevent the potential for ingestion of surface water containing contaminants having greater than 10^{-4} to 10^{-6} excess cancer risk, or having a hazard index greater than 1.0 for noncarcinogenic risk and/or in excess of chemical-specific ARARs.
- Prevent the potential for surface water/sediment contaminants in excess of chemical-specific ARARs.

Preliminary remedial action objectives for air may include:

- Prevent the potential for direct contact with surficial materials having greater than 10^{-4} to 10^{-6} excess cancer risk, or having a hazard index greater than 1.0 for noncarcinogenic risk and/or in excess of chemical specific ARARs.
- Prevent the potential for inhalation of, ingestion of, and/or dermal contact with particulates having greater than 10^{-4} to 10^{-6} excess cancer risk, or having a hazard index greater than 1.0 for noncarcinogenic risk and/or in excess of chemical-specific ARARs.
- Prevent emissions in excess of chemical-specific ARARs.
- Prevent the potential for inhalation of gaseous particulate and radioactive air emissions having greater than 10^{-4} to 10^{-6} excess cancer risk, or having a hazard index greater than 1.0 for noncarcinogenic risk and/or in excess of chemical-specific ARARs.

Site-specific remedial action objectives, usually based on the conclusions of a risk assessment, will provide the criteria for identification and development of remedial action alternatives. Further development of these objectives will involve identification of contaminants and affected media, evaluation of migration pathways, and determination of acceptable exposure levels at potential receptor points. Existing knowledge regarding site contamination is based on previous investigations described in Section 3.3, and will be expanded by the investigations described in Section 6 of this Work Plan.

4.3.2 Preliminary General Response Actions

General response actions are medium-specific actions that satisfy specific remedial action objectives. Preliminary general response actions have been identified based on the results of previous investigations and the preliminary conceptual site model. The development of response actions is a continuing process that is repeated and refined throughout the RI/FS effort as information about the site accumulates.

For each general response action, one or more remedial technologies may be applicable. As a better understanding of site conditions is gained, and specific remedial action objectives are identified, the general response actions list will be refined to more precisely address the specific contaminated media and remedial objectives. Preliminary general response actions which may be considered for soil, groundwater, surface water and sediments, and air are presented below:

Response Actions for Soils/Sediments

- No action
- Institutional controls
- Containment - provide barriers against contact or contaminant migration
- Excavation/treatment/stabilization/disposal
- In-situ treatment

Response Actions for Groundwater

- No action
- Institutional controls
- Containment
- Collection/treatment/disposal
- In-situ treatment

Response Actions for Surface Water and Sediments

- No action
- Institutional controls

- Containment
- Excavation/treatment/disposal

Response Actions for Air

- No action
- Institutional controls
- Containment
- Treatment
- Engineering controls

4.3.3 Identification of Volumes or Areas of Media to be Remediated

During the development of remedial alternatives, an initial estimate must be made of volumes and/or areas of contaminated media to which general response actions might be applied. Such an estimate must be developed for each medium of interest at the site. The development of such estimates will be in a large part based on the isopleths for specific contaminants that will be generated as part of the site characterization effort. The planning efforts necessary to define the limits of any plumes will also provide the raw data for identification of volumes or areas of media.

4.3.4 Preliminary Identification of Remedial Technologies

For each of the general response actions identified during the course of the RI/FS, feasible options and technologies will be identified. The candidate technologies and options will then be used to formulate remedial alternatives. As more specific site information is acquired, the options and technologies will be further screened based on their applicability to the site. Preliminary remedial technologies are presented below for the preliminary general response actions identified in Section 4.3.2. These technologies are based on very preliminary information about the site; additions and deletions to these technologies are to be expected as the RI/FS process progresses.

The remedial technology selection process will entail careful consideration of site-specific factors for Eastern Michaud Flats. The unique nature of soil and groundwater contamination at the EMF site indicates the need for specialized remedial strategies. As discussed earlier, the pyrophoric nature of elemental phosphorus presents unusual safety hazards when excavating soil. The selection of an effective groundwater treatment process requires specialized knowledge as to the particular form (ionic species, valence state, crystalline structure, etc.) of any contaminants which may be present. Thus, as an initial goal of groundwater treatability testing, the chemical and physical state of arsenic, selenium, and any other relevant constituents should be investigated.

4.3.4.1 *Remedial Technologies for Soils/Sediments*

Institutional Controls. Institutional strategies are those which consist of an administrative approach to a problem as a remedial approach. Institutional controls include actions such as fencing to provide limited access to the areas of contamination. Both facilities are currently fenced. This action could involve the installation of additional fencing around localized contaminated areas within the facility grounds to restrict or eliminate access to potential source areas. Institutional controls might also include deed restrictions to limit the future usage of contaminated areas.

Containment. Containment technologies include capping, slurry walls, horizontal barriers such as liners, and stabilization. Capping may be an appropriate technology at the site, particularly at the FMC facility, since it would eliminate the need for excavation or disturbance of any phosphorus-containing soil. Stabilization can be performed in-situ to likewise avoid or defer the need for soil excavation. As noted earlier, many of the surface impoundments at the two facilities are currently lined. Lining of the remaining unlined ponds and ditches could be used to minimize further contamination of soils and migration of contaminants to the groundwater.

Excavation/Treatment/Disposal. In general, contaminated soil can be excavated and subsequently treated by soil washing or by utilizing a specially designed thermal and/or chemical treatment system. If such methods are applicable at EMF, the treated soil could then be used as backfill on site. The treatment technology would need to be designed for extraction or immobilization of the constituents of concern, and oxidation or removal of elemental phosphorus from any phosphorus-containing soils, and would thus require significant treatability testing beforehand. As mentioned above, the safety hazards associated with elemental phosphorus introduce an added danger into any soil excavation activities at the FMC facility.

In-situ Treatment. An in-situ treatment technology such as soil flushing, stabilization, or vitrification may be appropriate for portions of this site in order to avoid excavation of phosphorus-containing soil.

4.3.4.2 *Remedial Technologies for Groundwater*

Institutional Controls. In addition to fencing, institutional controls for groundwater remediation can include groundwater monitoring. Monitoring wells can be used to track contaminant migration and to evaluate if further remedial actions are necessary.

Containment. In addition to capping, which reduces the migration of contaminants, containment of groundwater contamination by hydraulic controls may be feasible. A network of extraction wells pumping contaminated groundwater could alter the direction of groundwater flow and thus reduce or eliminate the offsite migration of contamination. The extracted water may require treatment before disposal or could possibly be used in the facilities as process water.

Collection/Treatment/Disposal. Groundwater treatment could be used in an attempt to minimize the potential for migration of contaminants and reduce contaminant concentrations in the aquifer. Chemical precipitation, ion exchange, and reverse osmosis are potentially applicable treatment technologies that could be used in conjunction with extraction wells. The presence of high concentrations of dissolved solids in the groundwater complicates the situation, and likely requires that treatability testing be performed to confirm the effectiveness of any prospective groundwater treatment process. Extracted groundwater could be used in process operations, treated and discharged to surface water or publicly owned treatment works, or treated and reinjected.

In-situ Treatment. Groundwater treatment could also be performed in-situ. In-situ treatment might include the introduction of microbial or oxidation/reduction agents to the subsurface.

4.3.4.3 Remedial Technologies for Surface Water and Sediments

Institutional Controls. Institutional controls for surface water remediation could include establishment of a monitoring program. Surface water samples can be collected from a nearby river, springs, and discharge points to track contaminant migration and to evaluate whether further remedial actions are necessary.

Containment. The types of containment measures that may be considered for surface water and sediments include capping, grading, vegetation, and diversion and collection systems. These surface water control measures are designed to minimize contamination of surface waters and sediments, prevent surface water infiltration through contaminated soils, and prevent offsite transport of contaminated surface waters and sediments.

Excavation/Treatment/Disposal. Contaminated sediments could be excavated, dewatered, if necessary, and treated similarly to other contaminated soils.

4.3.4.4 Remedial Technologies for Air

Institutional Controls. Institutional controls might include air monitoring. Air monitoring stations would be used to collect air samples to evaluate if further remedial actions are necessary.

Containment. Capping, liners, or vegetative covers can be used to reduce the migration of contaminants to air. Wind fences can also be used to reduce wind-blown contamination.

Treatment. Any dry or dusty areas can be treated with chemical dust suppressants to reduce migration of wind-blown contaminants to air. Water sprays can also be used to keep dry areas moist, reducing contaminant migration to air.

Engineering Controls. Engineering controls can be used in plant operations to minimize the generation of dusts. Enclosing dust-generating operations and converting dry material handling operations to wet are examples of engineering controls, as is the use of stack emission control devices.

A summary of preliminary response actions and potential remedial technologies is provided in Table 4-1.

4.4 PRELIMINARY IDENTIFICATION OF OPERABLE UNITS

A preliminary list of potential EMF site operable units is presented in Table 4-2. As additional information becomes available throughout the RI/FS, the subject of operable units will be revisited. Early identification of operable units for the site will facilitate understanding of the areas, sources, and media of contamination, and the feasibility of any proposed remedial actions for these contaminated areas. Potential operable units have been developed on the basis of geographic location, similarity of activity, and similarity of potential source constituents. The potential operable units include active units, closed units, and inactive units that may have contributed to site contamination in the past, and associated contaminated media. Units or media containing elemental phosphorus will likely constitute a distinct operable unit(s) because of the potential safety risks associated with the exposure of elemental phosphorus to air.

4.5 PRELIMINARY IDENTIFICATION OF ARARs

The identification of ARARs involves determining whether a given requirement is applicable, and if it is not applicable, determining whether it is nevertheless both relevant and appropriate. Applicable requirements are those standards of cleanup or control, and other substantive environmental protection requirements, criteria,

Table 4-1
PRELIMINARY RESPONSE ACTIONS AND POTENTIAL REMEDIAL TECHNOLOGIES

Potential Response Actions	Potential Remedial Technologies
Soil/Sediment	
No Action	
Institutional Controls	Fencing Deed Restrictions
Containment	Capping Slurry Walls Liners Stabilization
Excavation/Treatment/Disposal	Soil Washing Thermal Treatment Chemical Treatment Physical Treatment
In-Situ Treatment	Soil Flushing Stabilization Vitrification
Groundwater	
No Action	
Institutional Controls	Groundwater Monitoring
Containment	Capping Hydraulic Controls
Collection/Treatment/Disposal	Chemical Precipitation Ion Exchange Reverse Osmosis
In-situ Treatment	Microbial Treatment Oxidation/Reduction
Surface Waters and Sediments	
No Action	
Institutional Controls	Surface Water Monitoring
Containment	Capping Grading Vegetation Diversion and Collection Systems
Excavation/Treatment/Disposal	(See technologies identified for Soils/Sediment and Groundwater above).

Table 4-1 (Cont'd)

Potential Response Actions	Potential Remedial Technologies
Air	
No Action	
Institutional Controls	Air Monitoring
Containment	Capping Liners Vegetative Cover Wind Fences
Treatment	Dust Suppressants Water Sprays
Engineering Controls	Enclosures Process Modifications

Table 4-2
PRELIMINARY IDENTIFICATION OF OPERABLE UNITS[a]

EMF Site Location	Potential Operable Units	Potential Migration Pathways: Soil/ Groundwater	Potential Migration Pathways: Air
FMC[b]	Old Calciner Ponds; Calciner Ponds 1C-4C	X	
	Calciner Fines Storage Area	X	X
	Active areas containing phosphorous - Ponds 8S, 8E, 9E,	X	
	11S, 12S, 13S, 14S, 15S[c]; Railroad Swale	X	
	Closed facilities potentially containing phosphorous -		
	Old Ponds 1E, 2E, 3E, 4E, 5E, 6E, 4S, 5S, 6S, 7S, 10S	X	X
	Old Ponds 00S, 0S, 1S, 2S, 3S; Area 9S	X	X
	Kiln Scrubber Ponds	X	X
	Operating Areas: Ore Receiving/Storing/Handling Facilities; Plant Roads	X	X
	Chem Lab Seepage Pit; Septic Tank Drainfields	X	
	Stacks and Vents		X
	Slag Pile; Ferrophos Pile	X	X
	Landfills	X	
	Bannock Paving Area	X	X
	IWW Basin, IWW Drainage Channel	X	
Simplot[d]	Gypsum Stacks	X	X
	East Overflow Pond	X	
	Water Treatment Ponds/Ditch/Dewatering Pit[e]	X	
	Plant Roads	X	X
	Stacks and Vents		X
	Loadout and other plant operational areas	X	X
Overall	Groundwater	X	

Notes:

(a) Operable units listed in this table are preliminary. Data collected during the RI will be used to add to, delete, or regroup units on this list.

(b) Materials containing phosphorus will require special safety considerations due to the spontaneous ignition of phosphorus when exposed to oxygen.

(c) FMC has submitted a RCRA Part B application to the EPA which addresses management of these units. The process under which other potential sources of contamination shown on this table may be remediated has not been determined.

(d) As of September 1991, ore is transported to the Simplot facility in slurry form. Thus, Simplot ore receiving, storage and handling operations are no longer a point source of particulates.

(e) These ponds are located on Simplot-owned property off the the plant site proper.

or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site. Relevant and appropriate requirements are those standards, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that the requirement's use is well suited to that particular site.

The EPA is responsible for initiating and coordinating the involvement of its respective program offices and other agencies in developing information on ARARs.

During the RI, ARARs will be considered for contaminants, locations, and actions of concern. As the RI progresses, potential ARARs will be evaluated in accordance with "CERCLA Compliance with Other Laws Manual" (EPA, 1988) to determine whether they are applicable or relevant and appropriate to the EMF site. Requirements will be identified and refined as a better understanding is developed of site conditions, contaminants, and remedial action alternatives. A preliminary list of potential federal and state ARARs for the EMF site is presented in Appendix C.

5. RI/FS Tasks

Section 5
RI/FS Tasks

This section describes the data needs and tasks required to conduct an RI/FS of the EMF site. The primary objectives of the RI/FS are to:

- Determine the nature and extent of site contamination
- Develop the data necessary to perform a risk assessment
- Determine the potential effects of site contamination on public health and the environment
- Develop a cost-effective remedial action for the abatement of site contamination.

Data needs to meet these objectives have been identified based on an evaluation of existing data and the conceptual site model presented in Section 4.1, and are presented in Section 5.1. PRPs commit to the collection of sufficient data to satisfy the data needs of the risk assessment.

Data quality objectives to be met in the collection of these data are presented in Section 5.2. The tasks to be performed are described in Section 5.3. A phased investigation approach will be used to meet data needs for the EMF site RI/FS. The Phase I activities will collect sufficient information for development and, if necessary, screening of remedial alternatives. Subsequent investigations, if required, will be developed on the basis of the data obtained in Phase I. EPA may elect to specify subsequent investigations it deems necessary. Site characterization activities and the Phase I RI scope of work are presented in Section 6.

5.1 DATA NEEDS

Additional EMF site data are needed to confirm and expand the conceptual model described in Section 4.1. In particular, data are needed to assess whether the potential sources of contamination are releasing contaminants to identified pathways, to assess the magnitude and extent of contamination via these pathways, to assess the potential for future migration via these pathways, and to identify potentially affected receptors. A summary of the data types required to evaluate potential sources, release mechanisms, and migration pathways is presented on

Table 5-1. Data needed to aid in the evaluation of general response actions and remedial technologies identified in Section 4.2 are presented on Table 5-2.

A phased approach will be used to collect the data necessary to meet the data needs identified in Tables 5-1 and 5-2. This approach will be used throughout the RI/FS. Phase I will include an evaluation of existing data on air emissions and potential receptors, in addition to the sampling and analysis of potential sources of contamination, surface soils, groundwater, surface water, and sediments. Detailed dispersion modeling will also be performed. The data will be used to validate/revise the conceptual model described in Section 4, and develop remedial alternatives. An evaluation of the results of these efforts against remaining data needs will be used to determine the need for any subsequent phases.

To examine potential sources of contamination, data are needed on the characteristics of waters and/or wastes discharged to units (e.g., ponds) identified in the conceptual model as potential sources of contamination. Characterization of soils and/or sediments beneath these units is also required to define the extent of, or potential for, migration of contaminants from the units.

To examine contaminant migration via air, data are needed on site meteorology and air quality. Existing data were discussed in Sections 3.1.4 and 3.1.5. Data are also needed on chemical types and constituents of surface soils in the vicinity of the two facilities to assess the deposition of contaminants transported by particulates from the facilities.

To examine contaminant migration via groundwater, data are needed to:

- Further define geologic and hydrogeologic conditions, including delineation of lateral extents and depths of specific geologic units
- Further determine the extent of contamination
- Delineate the extent of and interrelationships between shallow and deep unconsolidated water-bearing intervals
- Further define the occurrence and movement of groundwater

Table 5-1
TYPES OF DATA REQUIRED TO EVALUATE POTENTIAL
RELEASE MECHANISMS AND ENVIRONMENTAL PATHWAYS

		CONTAMINANT CHARACTERIZATION							SOIL (Applicable to Saturated & Unsaturated Zones)								ROCK		SURFACE WATER				GROUNDWATER				SEDIMENTS			AIR*			BIOTA							FACILITIES	
		RADIOLOGICAL				CHEMICAL																											FLORA			FAUNA					
TRANSPORT MEDIUM	RELEASE MECHANISM	ACTIVITY TYPES	ISOTOPES	VERTICAL & AREAL CONCENTRATION	PHYSICAL CHARACTERISTICS	CONTAMINANT TYPES	VERTICAL AND AREAL CONCENTRATIONS	PHYSICAL & CHEMICAL CHARACTERISTICS	TYPE	MOISTURE CONTENT	POROSITY	GRAIN SIZE	SPECIFIC GRAVITY	PERMEABILITY	LEACHABILITY	DISTRIBUTION COEFFICIENT	TYPE	PERMEABILITY	LEVELS	DRAINAGE PATTERNS	FLOW RATES	INFILTRATION	LEVELS	FLOW DIRECTION	FLOW RATES	DISCHARGE TO SURFACE WATER	TYPE	TRANSPORT AND DISPOSITION	QTY., KIND, ORIENT. OF VEGETATIVE COVER	AIR QUALITY OBSERVATIONS	LOCAL METEOROLOGY OBSERVATIONS	INVERSION CLIMATOLOGY	FLORA	AREAL DISTRIBUTION	UPTAKE	FAUNA	AREAL DISTRIBUTION	UPTAKE	SIGNIFICANT FOOD CHAINS	CONDITIONS	OPERATIONS
SOIL	INFILTRATION/PERCOLATION	●	●	●	●	●	●	●	●	●	□	●	□	●	%□	□	●	●																						●	
	DUST EMISSIONS	●	●	●	●	●	●	●	●	●	□	●	□	●	%□	□													□	●%□	%□										
	WIND EROSION	●	●	●	●	●	●	●	●			●	□																□	●%□	%□										
AIR	ONSITE PRODUCTION ACTIVITY	●	●	●	●	●	●	●	●	●		●	□	●	%□	□													□	●%□	%□	%□									○
	WIND BORNE DUST EMISSIONS	●	●	●	●	●	●	●	●	●		●																	□	●%□	%□	%□								○	○
SURFACE WATER AND SEDIMENTS	SURFACE WATER DISCHARGE	●	●	●	●	●	●	●											□	%□	●							□													○
	GROUNDWATER RECHARGE	●	●	●	●	●	●	●											□		●	□	●	●	●	□	●	□													
GROUNDWATER	CONTAMINATED SOIL CONTACT	●	●	●	●	●	●	●	●	●	□	●	□	●	%□	□							●	●	●		●													○	
	GROUNDWATER INFILTRATION	●	●	●	●	●	●	●	●	●	□	●	□	●	%□	□							●	●	●	□															
FOOD CHAIN (BIOTA)	TERR. FLORA/FAUNA UPTAKE	●	●	●	●	●	●	●																									□	□	□	□	□	□	□		
	AQUATIC FLORA/ FAUNA UPTAKE	●	●	●	●	●	●	●																									□	□	□	□	□	□	□		

LEGEND:

- ● Field sampling data
- ○ Existing FMC and/or Simplot data
- □ Data to be obtained from literature
- * An Air Sampling and Monitoring Plan will be prepared and submitted as a separate document

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Table 5-2
TYPES OF DATA REQUIRED FOR THE IDENTIFICATION OF APPLICABLE REMEDIAL TECHNOLOGY

REQUIRED DATA ITEMS (b)

General Response Actions (a)	Remedial Technology	Contaminant Source Pathways: Soil	Sediments	Groundwater	Surface Water	Air	Biota	Waste Form: Liquids	Solids	Site Conditions: Accessibility	Topography	Native Vegetation	Waste Characteristics: Physical States	Chemical Composition	Disposal Practices	Phys./Chem. Properties	Extent of Contamination
INSTITUTIONAL CONTROL		●	●	●	●	●/□	□	●	●	●	●/□	●/□	●	●	○	●	●
CONTAINMENT	CAPPING/LINERS (c)	●	●	●	●	●/□			●	●	●/□	●/□	●	●	○	●	●
CONTAINMENT	EXTRACTION WELLS	●	●	●	●					●	●/□		●	●	○	●	●
CONTAINMENT	STABILIZATION	●	●	●				●	●	●	●/□	●/□	●	●	○	●	●
CONTAINMENT	REVEGETATION	●	●							●	●/□	●/□	●	●	○	●	●
REMOVAL	EXCAVATION	●	●						●	●	●/□	●/□	●	●	○	●	●
TREATMENT	VOLUME REDUCTION								●	●	●/□	●/□	●	●	○	●	●
TREATMENT	PHYSICAL TREATMENT	●	●	●	●	●/□		●	●	●	●/□	●/□	●	●	○	●	●
TREATMENT	CHEMICAL TREATMENT	●	●	●	●	●/□		●	●	●	●/□	●/□	●	●	○	●	●

General Response Actions (a)	Remedial Technology	Site Geology: Seismic History	Depth to Bedrock	Bedrock Type	Bedrock Profile	Structural Configuration	Structural Strength	Bedrock Permeability	Soil: Profile to Bedrock	Type/Texture	Permeability/Porosity	Engineering Properties	Soil Chemistry	Erosion Potential	Moisture Content
INSTITUTIONAL CONTROL															
CONTAINMENT	CAPPING/LINERS (c)	□	●	□			●		●	●	●	●	●	□	●
CONTAINMENT	EXTRACTION WELLS		●	□					●	●	●				
CONTAINMENT	STABILIZATION	□	●	□	●	●	●	●	●	●	●	●	●	□	●
CONTAINMENT	REVEGETATION								●	●	●		●	□	●
REMOVAL	EXCAVATION									●					●
TREATMENT	VOLUME REDUCTION		●	□	●				●		●	●	●		●
TREATMENT	PHYSICAL TREATMENT		●	□	●	●		●	●	●	●	●	●		●
TREATMENT	CHEMICAL TREATMENT		●	□	●	●		●	●	●	●	●	●		●

General Response Actions (a)	Remedial Technology	Groundwater: Groundwater Chemistry	Seasonal Potentiometric Surfaces	Aquifer Profile	Aquifer Characteristics	GW Velocity & Dir. of Flow	GW Recharge & Discharge Areas	Surface Water: Proximity of Nearest SW	Presence of Leachate Seeps	Floodplain Boundaries	Stream Profiles	Surface Water Use	Drainage Area/Runoff	Local SW Quality	Streamflow Characteristics	Climatology: Evapotranspiration Parameters	Wind Speed & Direction	Temperature Parameters	Precipitation	Local Air Quality	Inversion Climatology
INSTITUTIONAL CONTROL																□	●/○/□	●/□	□	□	○
CONTAINMENT	CAPPING/LINERS (c)		●					●/□	□	□	□	□	□			□	●/○/□	●/□	□	□	○
CONTAINMENT	EXTRACTION WELLS	●	●	●	●	●	□	●/□	□	□		□	□		●/□						
CONTAINMENT	STABILIZATION							●/□	□	□					●/□			●/□			
CONTAINMENT	REVEGETATION		●						□	□						□	●/○/□	●/□	□		
REMOVAL	EXCAVATION		●						□	□			□				●/○/□	●/□	□	□	○
TREATMENT	VOLUME REDUCTION																				
TREATMENT	PHYSICAL TREATMENT	●	●	●	●	●	□	●/□	□	□		□	□	□		□	●/○/□	●/□	□	□	○
TREATMENT	CHEMICAL TREATMENT	●	●	●	●	●	□	●/□	□	□		□	□	□		□	●/○/□	●/□	□	□	○

LEGEND:

(a) General response actions adapted from *Remedial Investigation and Feasibility Study Guidance Document*, Table 4-1, draft issued July 24, 1987.

(b) Required data items adapted from *Remedial Action at Waste Disposal Sites*, Figure 2-3 (EPA/625/6-85/006).

(c) Capping included as an air pollution control, surface water control, and leachate and groundwater control remedial technology.

● Field data required.

○ Existing FMC and/or Simplot data

□ Data to be obtained from literature

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- Further define the water quality correlation between groundwater, springs, and the river
- Further define groundwater quality upgradient of potential sources of contamination.
- Further define groundwater quality downgradient of potential sources of contamination
- Further define characteristics of water-bearing intervals (hydraulic conductivity, transmissivity, and storativity)
- Further define groundwater flow velocity in shallow and deep water-bearing intervals
- Establish hydraulic conductivities for various hydrostratigraphic units over a large area
- Establish hydraulic gradients near the Portneuf River to determine interaction between groundwater and river.

To examine contaminant migration via surface water, data are needed on surface water quality up and downriver of FMC's surface water discharge point. Data are also needed on the quality of water in the Portneuf River and associated springs and the chemical constituents of sediments up and downriver of the EMF site.

5.2 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) were developed during the planning process for work to be performed at the EMF site to ensure that quality data are collected during the different phases of the project and that the data collected are appropriate to the intended use and contribution towards meeting the RI/FS objectives. The intended uses of data collected include site characterization, confirmation of field data, support for studies for technology selection, and risk assessment. The development of DQOs is an iterative process. Therefore, it is anticipated that DQOs may be modified subsequent to the evaluation of information obtained during earlier stages and prior to the initiation of the next RI phase.

DQOs for work to be performed at the EMF site are expressed in terms of the following data quality goals: 1) to obtain data that are precise, accurate, representative, comparable and complete (PARCC parameters); 2) to obtain data with appropriate detection limits adequate for risk assessment purposes and so that the attainment of ARARs can be assessed; and 3) to obtain data using appropriate analytical support levels according to its intended use and to specify the appropriate level of data validation to be performed for the data set. DQOs are detailed in the Sampling and Analysis Plan (SAP) (Bechtel, 1992a).

Existing data will be evaluated on procedural correctness, applicability to the EMF site, and analytical accuracy. Satisfactory data will be included in the databases.

5.3 RI/FS TASKS

The RI/FS will encompass the following tasks:

- Task 1 - Scoping
- Task 2 - Community Relations
- Task 3 - Site Characterization
- Task 4 - Risk Assessment
- Task 5 - Treatability Studies
- Task 6 - Identification and Screening of Remedial Alternatives
- Task 7 - Evaluation of Remedial Alternatives

The deliverables and schedule associated with each of these tasks are presented in Section 8.

5.3.1 Task 1 - Scoping

Scoping is the initial planning phase of the RI/FS process. Project planning decisions and special concerns associated with the site are discussed in this phase. The preliminary identification of ARARs, data quality objectives, operable units and preliminary remedial actions lead to the development of sampling strategies, analytical support plans and health and safety protocols. Scoping activities comprise the first steps in the initial evaluation of the site. A Sampling and Analysis Plan which includes the Field Sampling Plan and the Quality Assurance Project Plan outlines the data collection program to be implemented as part of the RI/FS. The initial strategy to be used to perform the RI/FS was determined during the scoping process and is presented in this work plan.

Scoping is presently an ongoing task. Existing information on potential sources of contamination, pathways, and receptors has been collected and reviewed for completeness. Regional, historical, and site-specific literature have been similarly reviewed. Regional and site-specific data, particularly the 1991 FMC Facility Assessment (FMC, 1991b), have been similarly reviewed and evaluated in preparation for the first phase of the proposed field investigation. Scoping activities will continue as site conditions and possible remedial alternatives are better defined. Task 1 deliverables include this RI/FS Work Plan, a Sampling and Analysis Plan (SAP), and a Health and Safety Plan (HSP). An Air Monitoring Plan will also be issued and implemented as described in more detail in Section 6.2.

5.3.2 Task 2 - Community Relations

The EPA is responsible for the development and implementation of community relations activities. Project management and overall project support in the implementation of community relations activities will be provided as requested by EPA.

5.3.3 Task 3 - Site Characterization

Site characterization activities are intended to define the nature and extent of contamination and to assess the potential for migration. The contaminant distribution will be assessed by a program of drilling, monitoring well installation, and the sampling and analysis of various potential source and environmental media. Migration potential will be assessed by collecting and evaluating subsurface data, including stratigraphy, physical properties of soils, and aquifer characteristics. Site characterization will also include collection and evaluation of storm water and site drainage information. Site characterization and the Phase I scope of work are described in greater detail in Section 6.

The Phase I scope includes evaluating existing data on air emissions and biota to determine if these pathways and receptors are of concern. Groundwater, surface water, surface and subsurface soil, and sediment samples will be collected and analyzed as detailed in the Field Sampling Plan. After evaluation of Phase I data, the need for and scope of any additional investigations will be reviewed.

The following subtasks are performed during site characterization: preparation for field investigation; performance of field investigation; analysis and evaluation of data; implementation of data management procedures; and preparation of the preliminary site characterization summary and remedial investigation reports.

5.3.3.1 Preparation for Field Investigation

This subtask will include preparation of specifications for lab analyses and for drilling and lithologic identification, well installation, well development, groundwater sampling, and aquifer testing. Qualified firms will be selected to provide drilling, surveying, and laboratory services as described in this Work Plan. Equipment available locally for rental will be arranged and coordinated through the drilling firm selected for the project. Procurement of all field supplies and equipment required for the investigation will be included. Permits will be obtained for all proposed drilling and sampling activities, as required by the state. An underground utility survey will be necessary prior to drilling operations to locate pipe and utility lines in proximity to proposed drilling locations. Arrangements for handling of waste materials (drill cuttings, well development and sampling purge water, and aquifer testing discharge) will also be made.

The EPA will be notified at least two weeks in advance of initiation of field support activities. The State of Idaho Department of Health and Welfare and the Shoshone-Bannock Tribe will also be notified. EPA will also be notified in writing upon the completion of field support activities.

5.3.3.2 *Field Investigations*

The field investigations conducted as part of the site characterization will be carried out according to the following plans:

- Sampling and Analysis Plan (Part 1 - Field Sampling Plan, Part 2 - Quality Assurance Project Plan, SAP addendum dated 6-15-92)
- Health and Safety Plan

Each of these plans is a separate document that describes procedures which will be followed during field investigations and/or the rationale for selection of sample types and locations, as well as analytical parameters.

An overview of the proposed field investigation is described in Section 6. The elements consist of a potential source, air, surface soil, geologic, groundwater, and surface water and sediment investigations, as well as land use and ecological surveys. Data management activities to be performed during field investigations are described in Section 9.

Sample locations and analyses to be performed and the rationale for their selection will be presented in the Sampling and Analysis Plan. The Sampling and Analysis Plan includes both a Field Sampling Plan and a Quality Assurance Project Plan (QAPP). Detailed procedures for obtaining acceptable quality data are presented in the QAPP.

5.3.3.3 *Data Evaluation and Preparation of Remedial Investigation Report*

Data collected during Phase I and any subsequent phases of the RI will be evaluated to assess the nature and extent of potential sources, migration potential of contaminants from these sources, and potential receptors of any contamination detected in air, surface soils, groundwater, and surface water/sediments. A decision tree outlining the types of data to be collected in Phase I, the means by which the data will be evaluated, and the circumstances which will trigger additional data collection in Phase II is provided in Figure 5-1. Potential uses of these data in developing the Preliminary Risk Assessment (PRA) and the Feasibility Study are also indicated.

Potential source and environmental media data collected during Phase I field investigations will be reviewed to assess the nature and extent of environmental contamination and the probable sources, past or present, of the contamination. If the extent of contamination in one or more environmental media has not been adequately defined and/or if the source(s) of contamination is not evident, a subsequent program will be outlined to further define the extent of contamination and/or the sources. In addition, potential contaminant receptors, both human and ecological, will be surveyed in Phase I for use in EPA's assessment of site risk. If EPA determines that additional potential receptor and/or other data are needed to perform the risk assessment, a follow-on program will be outlined for the collection of these additional data.

Phase I findings will be presented in a Preliminary Site Characterization Report. The report will include a summary of field investigation and survey activities and findings, analytical data, supporting maps or drawings, evaluation of the potential for contaminant migration, and a discussion of any Phase II or additional RI data needs. The RI/FS schedule (see Section 8) indicates two subsurface field investigations (i.e., two groundwater monitoring well installation programs) prior to submittal of the Preliminary Site Characterization Report, which may reduce the need for collection of additional groundwater data in subsequent investigations. The Preliminary Site Characterization Report will also include a new site conceptual model, revised to indicate the potential contamination of environmental media observed in the review of Phase I data. The new conceptual model will also reflect any changes in the PRPs' understanding of the contaminant release mechanisms and/or exposure pathways elucidated by the data collected in Phase I.

At the completion of supplemental data collection activities, the data will again be evaluated as outlined for Phase I data in Figure 5-1. At this time, additional evaluations (e.g., modeling) of the potential for contaminant migration via the various transport and/or exposure pathways may be performed. The need for

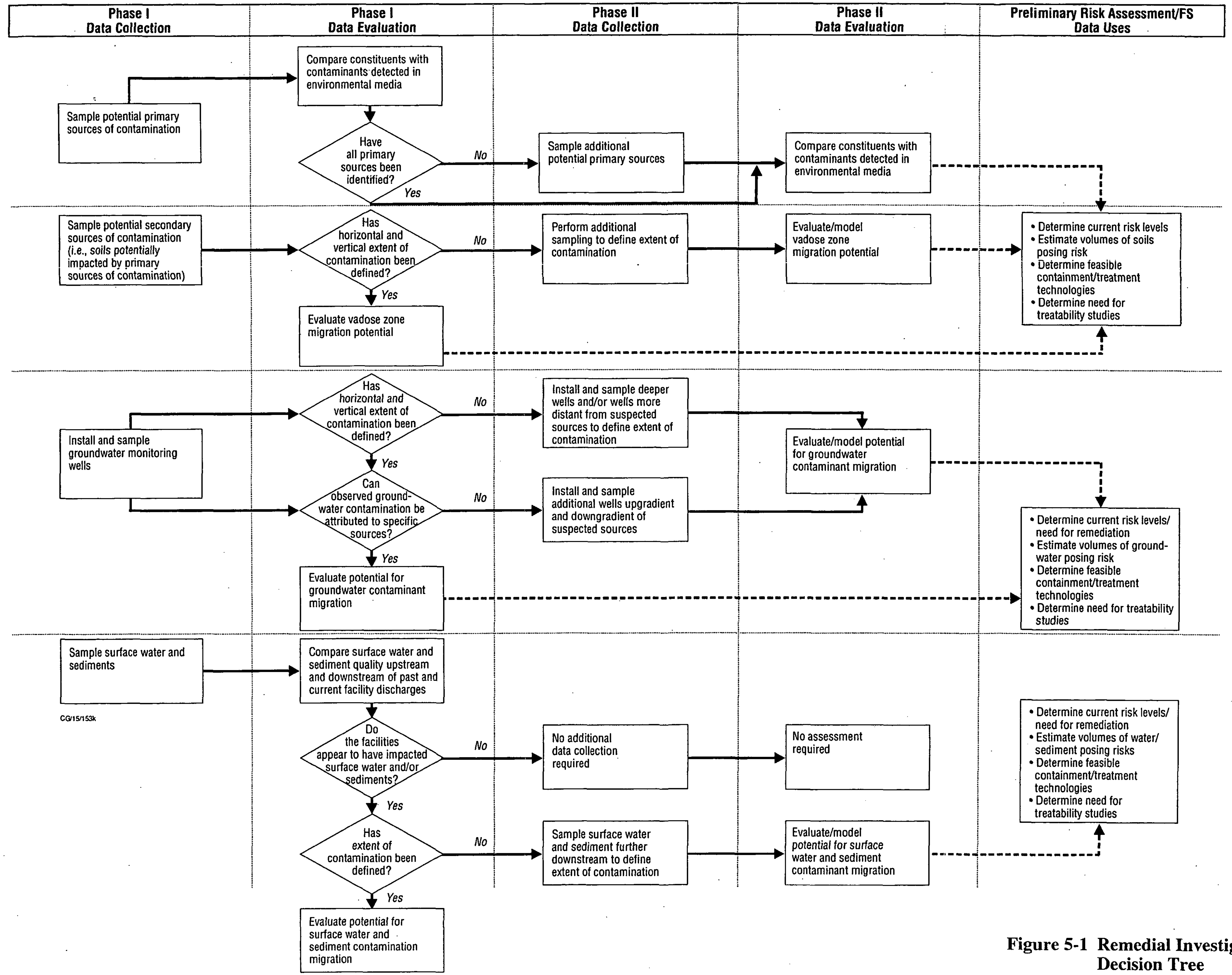

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Figure 5-1 Remedial Investigation Decision Tree

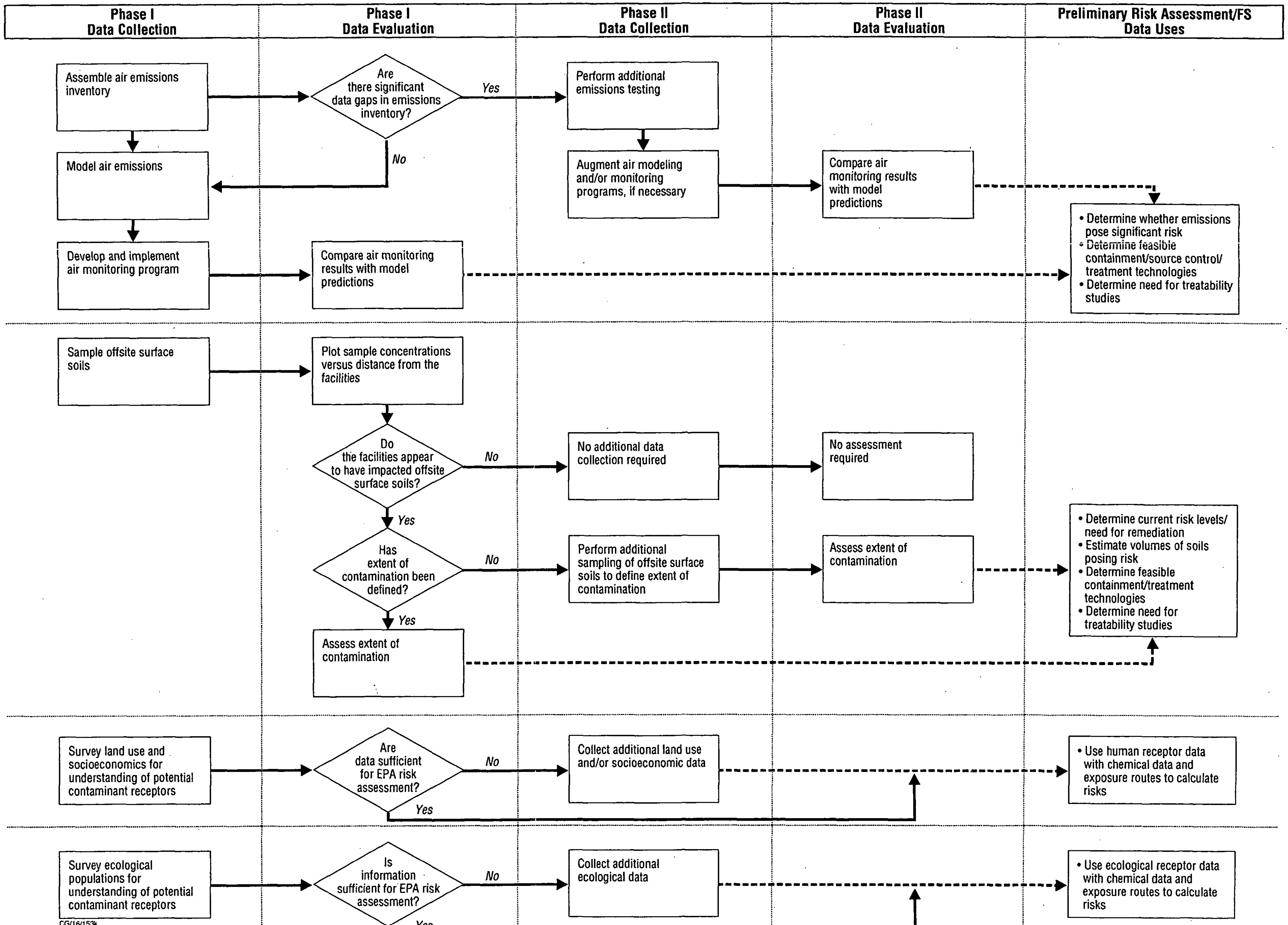

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Figure 5-1 (Cont'd)

additional evaluations will depend on the completeness of the database and the need for additional analyses to provide an accurate conceptual model of the site prior to completion of the Feasibility Study. Unless additional RI phases are required to complete the conceptual model of the site, a draft RI report will be prepared at the conclusion of Phase II. A final RI report will be prepared incorporating EPA comments on the draft.

5.3.4 Task 4 - Risk Assessment

EPA will conduct a risk assessment after the RI and before the FS. The risk assessment will satisfy the public health and environmental risk assessment requirements of the CERCLA process. Results of the risk assessment will be provided to FMC and Simplot for incorporation into the site characterization, and remedial alternatives, screening, and analysis portions of the RI/FS. Because of the interrelationships between RI/FS tasks to be performed and the EPA risk assessment, FMC and Simplot will closely coordinate RI activities with the EPA.

5.3.5 Task 5 - Treatability Studies

Treatability studies may be required to assist in the detailed analysis of alternatives. Treatability testing results and operating conditions may be used in the detailed design of a selected remedial technology if applicable.

A technical memorandum identifying appropriate candidate technologies for a treatability study program will be submitted to EPA for review and approval during project planning (Task 1). The specific data requirements for the testing program will be determined and refined during site characterization (Task 3) and the development and screening of remedial alternatives (Task 6).

A survey will be conducted to gather information on performance, relative costs, applicability, removal efficiencies, operation and maintenance requirements, and implementability of candidate technologies. If practical candidate technologies have not been sufficiently demonstrated, or cannot be adequately assessed for the site on the basis of available information, treatability testing will be conducted.

A statement of work outlining the steps and data necessary to evaluate and initiate the treatability testing program will be submitted to EPA if treatability testing is required. If treatability studies are needed, initial treatability testing activities will be planned to occur concurrently, if possible, with site characterization activities.

Deliverables to be submitted to EPA prior to the initiation of the treatability testing program include a memorandum on the identification of candidate technologies, a treatability testing statement of work, a work plan, a sampling and analysis plan, and a health and safety plan. Following completion of treatability testing, technical results will be analyzed and interpreted in a technical report to EPA. The report will evaluate each technology's effectiveness, implementability, cost, and actual results as compared with predicted results. The report will also evaluate full-scale application of the technology, including a sensitivity analysis identifying the key parameters affecting full-scale operation.

5.3.6 Task 6 - Identification and Screening of Remedial Alternatives

Feasibility study activities begin with the preliminary identification of operable units, and preliminary remedial response objectives and remedial action alternatives in the scoping phase (Task 1) of the RI/FS. As new data are collected, the remedial action objectives and alternatives will be reviewed and reevaluated as frequently as necessary. When the site characterization is near completion, the specific remedial technologies which address each of the general response actions will be identified. These technologies will be screened to eliminate technologies which are highly unlikely to satisfy remedial objectives.

Overall remedial action objectives for the site consist of medium-specific goals for protecting human health and the environment. Development of specific objectives involves identification of the media of concern and contamination characteristics, evaluation of exposure pathways for contaminant migration, and determination of acceptable exposure at the receptor points.

The development of alternatives will involve assembling combinations of remedial technologies applicable to each contaminated medium. A number of different alternatives will be assembled and screened to reduce the number that will be submitted to detailed analyses. The alternatives that survive the screening process will then be further refined and analyzed in detail with respect to prescribed evaluation criteria.

5.3.6.1 *Development of Remedial Action Alternatives*

The development of remedial action alternatives will involve five subtasks. The subtasks are:

- Develop risk-based or ARARs based remedial objectives
- Develop response actions
- Determine volumes and areas of media to be remediated
- Identify and screen remedial technologies and process options to select a representative process for each technology
- Develop remedial alternatives by assembling selected technologies.

These subtasks are described further below.

Develop Remedial Action Objectives. Specific remedial action objectives will be developed for each contaminated medium based on state and federal cleanup standards in conjunction with the site risk assessment for each identified contaminated media, the nature of the contaminants, the exposure pathways, and the remedial goals.

Development of specific remedial objectives will involve identification of contaminants and affected media based on site assessment, evaluation of contaminant migration, and determination of acceptable exposure levels at the receptor points.

Develop General Response Actions. The objective of this task is to develop site-specific response actions. Those general actions such as removal/treatment or containment of contaminated media that satisfy specific remedial objectives will be identified. Developing general response actions is an iterative process that takes place at several points during the RI/FS process. As more data are collected, alternatives (response actions, technologies, and remedial alternatives) are rescreened and modified as required.

For each general response action, one or more remedial technologies may be applicable.

Determine Areas and Volumes of Media to be Remediated. To develop remedial action alternatives, volumes or areas of contaminated media should be determined. Determination of volumes or areas of contaminated media is an iterative process that will be refined as the RI/FS progresses. In certain cases, such as the excavation of soil, determination of the exact volumes or areas may not occur until actual excavation.

For this site, volumes and areas of contaminated material will be defined based on specific contaminants or groups of contaminants, locations, and contaminant concentrations.

The development of remedial alternatives will also require knowledge of waste characteristics in addition to the volume of media to be remediated. Information will be required for the following waste characteristics (see Table 5-2): physical states, chemical composition, disposal practices, and physical and chemical properties.

Identify and Screen Remedial Technologies. The objective of this task is to select technologies and process options to be used to formulate remedial alternatives. For each of the general response actions developed in the previous task, feasible technologies and process options will be identified. These technologies and process options will then be screened based on their applicability to specific site conditions.

The total number of potentially applicable treatment technologies is reduced by screening of technologies with respect to technical implementability while considering specific site conditions, specific media of concern, and existing contaminants. Several broad technology types may be identified for each general response action, and numerous technology process options may exist within a technology type. As technologies pass the initial screening based on implementability, process options within the technology are evaluated to select one representative process option for each technology, if possible. The selection of process options is based on effectiveness in meeting risk-based remedial objectives, implementability, and approximate costs.

The technology types and process options will be summarized in a technical memorandum to be submitted to EPA for review and approval.

Develop Remedial Alternatives. In the development of remedial alternatives, the process options chosen to represent the various technologies for each of the media are combined to form alternatives for the EMF site as a whole. For a given medium there may be more than one remedial objective, each objective having several general response actions. For each general response action, more than one technology may be selected.

A summary of the selected representative alternatives for each affected medium or operable unit will be included in a technical memorandum to EPA. The technical memorandum will document the methods, rationale, and results of the alternative screening process.

5.3.6.2 *Screening of Remedial Alternatives*

The objective of alternative screening is to narrow the list of many potential alternatives to those that will be evaluated in detail. The screening will be based on the effectiveness of the alternatives in meeting risk-based remedial objectives, implementability, and approximate costs. A key aspect of the alternative screening process is an evaluation of the effectiveness of each alternative in protecting human health and the environment. Each alternative will be evaluated based on its protectiveness and its ability to effect a reduction in the toxicity, mobility or volume of contaminants.

Implementability will be evaluated based on the technical and administrative feasibility of constructing, operating, and maintaining the alternative. The alternatives which are not technically feasible or not available at this time will not be considered further. The cost data necessary for alternative screening will be based on published data such as cost curves, generic unit costs, vendor information, and similar estimates.

5.3.7 Task 7 - Evaluation of Remedial Alternatives

Technologies which survive the initial screening process will be grouped into remedial alternatives which satisfy various criteria (e.g., ability to meet risk-based remedial objectives, compliance with ARARs). The resulting list of alternatives will include a no action alternative. Alternatives will then undergo a cursory screening on the basis of factors such as environmental impact, compliance with ARARs, and order-of-magnitude cost.

Detailed evaluation of alternatives will include the development of conceptual level designs and cost estimates for each alternative and evaluation and relative ranking of the alternatives using technical, institutional, public health and environmental criteria. The evaluations will be used to prepare a summary of remedial alternatives.

5.3.7.1 *Detailed Analysis of Alternatives*

The objective of the detailed analysis of the alternatives is to develop the information necessary to select the site remedial action. The detailed analysis involves assessment of each alternative against the nine evaluation criteria. The results of the assessment will be organized to allow comparison of the alternatives.

The evaluation criteria consist of threshold criteria and primary criteria. The threshold criteria relate directly to statutory findings that must ultimately be made in the Record of Decision (ROD). Therefore, each alternative must satisfy the threshold criteria. The primary criteria are used to evaluate the technical, cost, institutional, and risk concerns of the various alternatives. The threshold and primary criteria are described below.

The threshold evaluation criteria are:

- Protection of Human Health and the Environment: evaluates how the alternatives protect and maintain protection of human health and the environment from existing and future health hazards and discusses whether the remedial action objectives are met
- Attainment of cleanup standards and compliance with applicable or relevant and appropriate federal and state laws (ARARs).

The primary evaluation criteria are:

- Short-term Effectiveness: examines the effectiveness of the alternative in protecting human health and the environment during the construction and implementation phase
- Long-term Effectiveness: evaluates the long-term effectiveness of the alternative in protecting human health and environment after the remedial action objectives have been met
- Reduction of Toxicity, Mobility, or Volume (TMV): evaluates the anticipated performance of the specific treatment technologies that comprise the alternatives
- Implementability: evaluates the technical and administrative feasibility of alternatives and the availability of required resources
- Cost: evaluates the capital costs and operating and maintenance (O&M) costs of the alternatives.

Additional criteria include:

- State Acceptance: reflects the state's preferences among, or concerns about, alternatives
- Tribal Acceptance: reflects tribal preferences among, or concerns about, alternatives
- Community Acceptance: reflects community preferences among, or concerns about, alternatives.

To conduct the detailed analysis, each alternative must be defined in detail and assessed against the threshold and primary criteria. The results of the assessment will be compared to determine relative performance of each alternative with respect to each evaluation criteria.

Definitions of alternatives will progress during the screening of technology-process options and development and screening of alternatives. During the detailed analysis, additional definitions of alternatives may be required to develop cost estimates.

Each alternative will be analyzed against the evaluation criteria independently, without the consideration of interrelationships between alternatives. Once an alternative is analyzed, the relative performance of each alternative will be evaluated.

5.3.7.2 *Summary of Remedial Alternatives*

A narrative summary describing all of the factors used to evaluate each remedial alternative will be used to compare the alternatives with one another. The summary will highlight important differences between alternatives and identify the advantages and disadvantages of each alternative relative to one another.

A report on the comparative analysis of potential remedial alternatives will be prepared and submitted to EPA. Upon completion of the remedial alternatives screening and evaluation tasks for each FS phase, a feasibility study report summarizing the results of the work tasks will be prepared.

The introductions of each FS report will include a summary of the findings of the applicable remedial investigations and the risk assessment. The remaining sections will summarize the work performed under the tasks outlined above.

A draft of the FS report will be issued. The draft will be submitted to EPA for review. EPA comments will be incorporated into a final FS report.

6. Phase I Remedial Investigation Scope

Section 6

Phase I Remedial Investigation Scope

This section describes activities to be performed at the EMF site during Phase I of the RI. The EMF site remedial investigation will use a phased approach so that a complete investigation can be conducted without duplication of efforts and generation of useless data. The phased approach begins with a review of existing data to determine what data gaps exist and to develop appropriate sampling programs for the investigations of various pathways and media; an initial review of existing data has already been performed to facilitate development of this Work Plan. The initial phase of the RI will emphasize data collection in the immediate vicinity of the operating facilities. Contaminant transport pathways to areas more distant from the facilities will be established prior to expanding the investigation area geographically in subsequent phases of investigation.

The phases for various studies within the RI (e.g., subsurface, surface water, air) will not necessarily coincide. Each study will have its own separate phased field sampling schedule, as appropriate. Details of the schedule are presented in Section 8.

The various Phase I studies are described in this section. If there are data gaps resulting from Phase I efforts, the criteria which will trigger subsequent phases of investigation are also presented. The scopes of the Phase I field activities are based on the EMF conceptual site model presented in Section 4 and the data needs identified in Section 5. If subsequent phases of investigations are needed, the programs will be developed and submitted to the EPA for its approval.

FIELD INVESTIGATIONS

Field investigations are the mechanism by which most of the data needed to complete characterization of site contamination will be collected. An overview of the types of samples to be collected and analyzed, the types of tests and surveys to be performed and the methods of sample collection and testing is presented in this section. A detailed description of the sample collection methodology to be used is presented in the Field Sampling Plan, Part 1 of the Sampling and Analysis Plan (SAP) (Bechtel, 1992a). Detailed procedures for obtaining representative, accurate, and precise data for samples to be collected and analyzed as well as for other field activities to be performed are presented in the Quality Assurance Project Plan (QAPP), Part 2 of the Sampling and Analysis Plan.

The following field investigations will be conducted in phases as part of the EMF RI: potential contaminant source, air, surface soil, geologic and subsurface soil, groundwater, surface water and sediment, and ecological investigations. Specific activities are described in the following subsections.

Phase I field activities will generally include:

- Sampling and analysis of water or waste streams which are discharged to potential sources of contamination identified in the conceptual site model (see Figure 4-1)
- Sampling and analysis of sludge/sediment in areas of potential contaminant sources identified in the conceptual site model
- Sampling and analysis of potentially contaminated soils in suspected source areas which may in turn represent a source of air emissions and/or a secondary source of contamination to groundwater
- Sampling and analysis of offsite surface soil samples for each major soil type and area in which chemical deposition of air emissions may have occurred in the vicinity of the two facilities
- Drilling of geologic borings which will be completed as monitoring wells
- Collection of unconsolidated subsurface soil samples for lithologic examination and physical analysis
- Sampling and analysis of groundwater samples from newly installed wells, as well as selected existing wells at the EMF site
- Sampling and analysis of surface water and sediment samples along a 10 mile segment of the Portneuf River and associated springs and ponds
- Reconnaissance to identify/verify land use and the presence of sensitive terrestrial and aquatic species and/or their habitats.

Other Phase I activities will include:

- Review of available meteorological, emissions and air quality data
- Air modeling followed by the development and implementation of an air monitoring program
- Review of existing data on surface soils downwind of the facilities
- Collection and review of existing data on land use and socioeconomics in the vicinity of the EMF site
- Collection and review of existing data on terrestrial and aquatic plant and animal species in the vicinity of the facilities.

Following the collection and evaluation of Phase I data for each study, the need for any subsequent phases will be determined as described in Section 5.3.3.3 and shown in Figure 5-1. Subsequent activities might include:

- Sampling and analyzing additional soils to further define the nature and extent of contamination.
- Installing additional groundwater monitoring wells to assess the horizontal and/or vertical extent of groundwater contamination if not ascertained in Phase I.
- Collecting surface water and sediment samples at additional locations if Phase I data indicate that the facilities have or are impacting the Portneuf River.
- Expanding the air modeling and/or monitoring efforts initiated in Phase I.
- Collecting additional ecological and/or land use data.
- Collecting data required to complete treatability studies, the risk assessment, and/or FS for which the need was unknown at the start of Phase I studies.

If subsequent investigations are required, a plan will be developed and submitted to the EPA for its approval.

ANALYTICAL PARAMETERS

The composition of the raw material (phosphate ore) used by the two facilities is the primary basis for the selection of analytes for each medium (e.g., groundwater, surface water/sediments, soil) to be tested. The principal analytical parameters of concern at the EMF site are metals and radionuclides contained in the raw materials. The composition, both inorganic and radiological, of phosphate shale processed by the FMC facility is summarized in Tables 6-1 and 6-2, respectively. Although the concentrations of these analytes may vary between the FMC and Simplot ores, these tables represent the principal analytes of concern for both facilities. Existing inorganic data for the water from Simplot's ore slurry pipeline are provided in Table 6-3. Table 6-4 presents radiological data on Simplot's phosphate ore.

A list of analytical parameters for each medium was generated for the Phase I RI based not only on knowledge of phosphate ore composition but also on historical data previously collected by FMC and Simplot, the EPA Data Needs Document (Ecology and Environment, June 1991) and the potential for these parameters to migrate from a potential source via a given pathway to a given environmental medium. The specific analytes for which each medium (potential source, groundwater, surface water, surface soil, and sediments) will be tested are presented in the sections which follow describing the scope of work for the investigation of each of these media.

The analyte lists for the different media are basically the same with the exception of parameters that only appropriately apply to a specific medium (e.g., water quality parameters on water samples only; total organic carbon on sediment samples only, and dissolved oxygen on surface water samples only). In addition, the preliminary list of contaminants provided by EPA in its Data Needs Document has been incorporated in its entirety into the EMF site RI/FS parameters lists with the exception of the following parameters: asbestos, silica, rubidium, PCBs, and specific radionuclides. Each of the parameters listed above are discussed below.

- Asbestos. Both facilities have always properly encapsulated and disposed of asbestos. With the exception of periodic disposal of asbestos in the FMC landfill, disposal of asbestos has always been offsite. In any case, there is no mechanism by which asbestos would migrate to groundwater beneath the EMF site or to air in its encapsulated form.

Table 6-1
FMC PHOSPHATE SHALE COMPOSITION
Inorganic Data

Item	1988 Total	1989 Total
Dry Tons	1,512,477.34	1,518,398.78
%H2O	10.1648	10.9259
%P2O5	24.71	24.66
%SiO2	24.17	24.34
%CaO	36.01	35.69
%LOI	6.08	5.84
%Fe2O3	1.27	1.31
%Al2O3	3.66	3.66
%MgO	0.41	0.44
%K2O	0.93	0.98
%Na2O	0.40	0.38
% Total C	2.90	2.30
%COMB C	1.73	1.69
%V2O5	0.19	0.20
%Cr2O3	0.17	0.15
%F	2.54	2.39
%S	0.46	0.44
%ZnO	0.15	0.15
%MnO	0.02	0.02
%SrO	0.08	0.14
%TiO2	0.189	0.21
ppm As	20.4	18.3
ppm LiO	52.6	38.0
ppm BaO	159.1	181.8
ppm Cd	102.9	93.2
ppm Sb	1.8	4.9
ppm Pb	---	9.3
ppm Se	0.32	6.4

Table 6-2
FMC PHOSPHATE SHALE COMPOSITION
Radiological Data (a)

Shale Type	MS 001 (b)	FS 001 (b)	HGS 001 (b)	RPS 001 (b)
Uranium-238	47.5 ± 3.4	50.3±2.5	41.5±3.1	70.0±3.4
Potassium-40	6.6±2.4	6.1±1.5	5.7±2.3	7.0±2.4
Polonium-210	12.0±1.3	7.6±1.2	5.0±0.8	13.5±1.5
Lead-210	<0.5	<0.5	<0.5	3.4±1.8

Notes:

(a) Radiological data for four different kinds of ore used at the FMC facility. Analyses were performed by Controls for Environmental Pollution, Inc. in Santa Fe, New Mexico. All units are in pCi/gram.

(b) MS=Mill Shale; FS=Furnace Shale; HGS=High Grade Shale; RPS=Rhone-Poulenc Shale.

Table 6-3
SIMPLOT'S SLURRY PIPELINE WATER
Inorganic Data
(All units in mg/l unless otherwise specified)

Parameter	Sample ID/Date Sampled	
	Conda Pipeline May-90	Composite Water from Smoky Conda Slurry August-89 - November-89
Alkalinity ($CaCO_3$)	176	196
Aluminum	0.15	0.28
Ammonia (NH_3-N)	1.89	0.05
Arsenic	0.007	<0.002
Barium	0.01	0.05
Beryllium	0.002	0.040
Bicarbonate	215	239
Boron	0.29	0.15
Cadmium	0.007	<0.001
Calcium	101.02	150.00
Carbonate	<0.10	<0.10
Chloride	24.0	20.9
Chromium	<0.010	<0.001
Cobalt	<0.03	<0.03
Conductivity (umhos/cm)	842	1,050
Copper	<0.01	<0.01
Fluoride	6.30	6.23
Iron	0.22	0.02
Lead	<0.002	<0.002
Lithium	0.02	0.05
Magnesium	16.52	18.76
Manganese	0.18	0.19
Mercury	0.0002	<0.0002

Table 6-3 (Cont'd)

Parameter	Conda Pipeline Slurry May-90	Composite Water from Smoky Conda Slurry August-89 - November-89
Molybdenum	1.59	1.80
Nickel	<0.03	0.09
Nitrate	0.17	0.20
Total Phosphate		5.10
Total Phosphorus	3.20	
Potassium	8.14	6.73
Selenium	0.004	0.010
Silica	33.28	28.10
Silver	<0.010	<0.005
Sodium	62.13	58.98
Sulfate	253	340
Total Dissolved Solids	804	712
Total Kjeldahl Nitrogen (ppm)	Not analyzed	0.10
Vanadium	0.29	0.36
Zinc	0.08	0.36
pH (pH units)	7.30	7.50

Table 6-4
SIMPLOT PHOSPHATE ORE
Radiological Data

Parameter	Conda Dryer Discharge Jul-89 Isotopic, pCi/gram
Gross Alpha	12.1±1.0
Gross Beta	31.8±0.7
Actinium-228	1.36±0.34
Bismuth-214	4.53±0.22
Lead-210	37.6±0.6
Lead-212	0.26±0.10
Lead-214	4.56±0.10
Polonium-210	0.37±0.06
Radium-224	<0.5
Radium-226	4.61±0.71
Radium-228	1.4±0.3
Radon-222	0.43±0.01
Thorium-228	<0.1
Thorium-230	<0.1
Thorium-232	<0.1
Thorium-234	<0.5
Thallium-208	0.74±0.24
Uranium-234	3.13±0.10
Uranium-235	0.13±0.05
Uranium-238	3.17±0.10

- Silica. Silica is not included in the analyte list because although it is a large component of the gypsum slurry, it is not hazardous unless it is in a respirable form. Silica will be considered in the air investigation.
- Rubidium. FMC and Simplot do not know of any rationale for the inclusion of rubidium.
- PCBs. PCBs will be analyzed in sediments because of general interest in the concentration of contaminants in river bottoms. Some soil samples will also be analyzed for PCBs where application of PCB-containing oils is known or suspected to have occurred. PCBs are not appropriate analytes for groundwater at this time since there is no known or suspected mechanism for mobilization of PCBs at the EMF site.
- Radionuclides. Samples will be screened for radioactivity by measuring gross alpha and gross beta. Any samples showing radioactivity in excess of upgradient or background levels by a statistically significant margin will be further analyzed to determine specific radionuclides present. (See Appendix E for discussion of statistical techniques). Because there is a maximum contaminant level (MCL) for radium-226 and radium-228, groundwater samples will be analyzed for these specific radionuclides if gross alpha or beta exceed levels reported for samples from upgradient wells by a statistically significant margin. This stepwise approach is consistent with the approach prescribed for radiological analysis of drinking water supplies in 40 CFR Part 141 in which radium analyses are only performed if gross alpha or beta levels exceed their respective MCLs.

  EPA has also expressed concern over the chemical toxicity of uranium. The concern is with uranium in the form of soluble salts. Uranium, if present, will be indicated by increased groundwater levels of gross alpha. Gamma spectroscopy will be performed to identify specific radionuclides if gross alpha levels exceed background. (See Appendix E for discussion of statistical techniques.)

  Radiological analyses will be performed on selected offsite surface soil samples to identify specific radionuclides present. Gamma spectrometry will performed along with specific tests for the identification of uranium-238 and polonium-210.

6.1 POTENTIAL CONTAMINANT SOURCE INVESTIGATION

Potential sources of contamination at the EMF site may be divided into several categories:

1) Materials and/or plant activities which may impact the air pathway

2) Waters and/or wastes which are released to surface waters or groundwater
3) Materials, waters, and/or wastes whose release may result in the contamination of surface and/or subsurface soils
4) Contaminated soils which may be secondary sources of contamination to groundwater

Some potential sources belong in more than one of the four categories. A specific list of potential sources was provided in the conceptual site model depicted in Figure 4-1.

The first category of potential sources, materials, and/or activities which may impact the air pathway, will be identified in a comprehensive emissions inventory as described in Section 6.2. The emissions inventory and preliminary air modeling simulations will be presented in a separate air pathways report/work plan which will be submitted to the EPA for its review and approval. This report/work plan will identify any needs for additional air emission source testing and will outline an air monitoring program. Sampling and analysis of some air emission sources will be accomplished by the sampling and analysis of the second and third potential sources categories described below (e.g., sampling and analysis of wastes such as slag and gypsum and unpaved surface soils, which have all been identified as potential sources of contamination for air and subsurface soils).

Plans for characterization of the potential sources in the remaining three potential source categories are described separately for the FMC and Simplot facilities in Sections 6.1.1 and 6.1.2 below. The proposed program is based on our current knowledge of site conditions and potential source areas, and may be adjusted in the field on the basis of materials/conditions encountered.

6.1.1 FMC Sources

Potential sources of contamination originating at the FMC facility are listed in Table 6-5 and described in Section 4.

6.1.1.1 *Phosphate Ore*

Phosphate ore, the primary raw material for the production of elemental phosphorus at the FMC facility, is the material from which the variety of trace elements found in FMC wastes are originally derived. Consequently, a composite sample of the ore will be collected and analyzed for the inorganic and radiological parameters in Table 6-6 to confirm the appropriateness of the analytical parameter list.

6.1.1.2 *Waters and Wastes*

FMC waters and/or wastes discharged to active units, such as ponds, will be collected and analyzed. Process streams that pose a potential substantial threat to the environment will be tested (i.e., streams that have the potential to exit to the environment via direct discharge or percolation). For FMC, the process wastewater streams that can impact the environment are precipitator slurry, phossy water, and scrubber blowdown. A 24-hour composite sample will be collected from each of the process streams mentioned above in Phase I to confirm historical data on the content of these streams with the exception of water collected from the railroad swale, which will be a location composite. The specific waters and/or wastes to be sampled and analyzed are:

- Water in the railroad swale
- Water discharged to the calciner ponds
- IWW ditch discharge to the Portneuf River
- Phossy water discharged to Ponds 11S through 14S and indirectly to Pond 15S and Pond 8S
- Precipitator slurry discharged to Ponds 8E and 9E

Solid wastes/byproducts which may contain potential sources of contamination will be sampled. These are:

- Slag from storage pile areas
- Ferrophos from storage pile areas

Table 6-5
FMC POTENTIAL SOURCE INVESTIGATION

Potential Sources	Location	Sampling Rationale	Media	Sample Depth	No. of Locations	Sample Intervals	Analytes	Notes	Upgradient Wells	Downgradient Wells
Ponds 11S, 12S, 13S, 14S--WMU#8 (Phase IV Ponds)	Fig. 6-1						Table 6-12	1, 7	137, 130•	104•, 131, 132
Pond 15S--WMU #3	Fig. 6-1						Table 6-12	7	101	113, 114, 115
Pond 8E--WMU #11	Fig. 6-1						Table 6-12	7	137	104, 131, 132
Pond 9E--WMU #9	Fig. 6-1						Table 6-12	7	124	126, 127, 128
Calciner Ponds 1C, 2C, 3C, 4C	Fig. 6-1						Table 6-12	7	142	136, 143
Old Ponds 0S, 00S	Not Shown						Table 6-12	2, 7		134•
Old Ponds 1S, 2S	Fig. 6-1						Table 6-12	2		134•
Old Pond 3S	Fig. 6-1						Table 6-12	2		134•
Old Ponds 4S & 5S	Fig. 6-1						Table 6-12	2		141
Old Ponds 6S & 7S	Fig. 6-1						Table 6-12	2	132	135, 140, 141
Pond 10S (dried)	Fig. 6-1						Table 6-12	2		135
Old Ponds 2E, 3E	Fig. 6-1						Table 6-12	1, 7	137, 130•	104•, 131, 132
Old Pond 7E	Fig. 6-1						Table 6-12			
Slag Pit WW Collection Sump--WMU #5	Fig. 6-2						Table 6-12	1, 7	121	108•, 122, 123
Slag Pile	Fig. 6-1						Table 6-12	7	101•	106, 142, 143
Kiln Scrubber Ponds	Fig. 6-1						Table 6-12	7	106	123, 144•
Landfill, inactive	Not Shown						Table 6-12	7	101•	106
Pond 8S--WMU #7	Fig. 6-1	Unlined pond, phossy wastes	Soil	to GW	3	SS, 10'	Table 6-6	2	116	118•, 119, 120
Old Ponds 1C, 2C	Fig. 6-1	Old ponds-calciner sludge	Soil	to GW	1	SS, 10'	Table 6-6		142	136
Pond 4E (dried)	Fig. 6-1	Old ponds-phossy water, ppt. dust	Soil	to GW	1	SS, 10'	Table 6-6			
Old Pond 5E	Fig. 6-1	Old ponds-phossy water	Soil	to GW	1	SS, 10'	Table 6-6			
Old Pond 6E	Fig. 6-1	Old ponds-phossy water	Soil	to GW	1	SS, 10'	Table 6-6			
Landfill, active	Fig. 6-1	Solid wastes-AFM	Soil	to GW	1	SS, 10'	Table 6-6, Organics			
Chemical Lab Drain Pit	Fig. 6-1	Drainfield-lab chemicals, organics	Soil	to GW	2	SS, 10'	Table 6-6, Organics	3		
IWW Basin/Ditch	Fig. 6-1	Cooling water-biocides, corrosion inhibitors	Soil	to GW	1	SS, 10'	Table 6-6			
				Subtotal	**11**					
Boiler Fuel Tank and Pipeline Area	Fig. 6-2	Pipeline leak, spills-TPH	Soil	50 feet	2	5.0'	Table 6-6, TPH			
Pond 1E (dried)	Fig. 6-1	Old ponds-phossy water, ppt. dust	Soil	15 feet	1	SS, 5'	Table 6-6	3		
Area 9S	Fig. 6-1	Old ponds-phossy water, ppt. dust	Soil	15 feet	1	SS, 5'	Table 6-6	3		
Transformer Salvage Area	Fig. 6-2	PCB leaks	Soil	10 feet	2	SS, 2.5'	Table 6-6, PCBs	3		
Waste Oil Storage Area	Fig. 6-1	Old ponds-phossy water, ppt. dust, PCBs, TPH	Soil	10 feet	2	SS, 2.5'	Table 6-6, PCBs, TPH	1, 3		
Railroad Swale	Fig. 6-1	Phos dock spills-phossy water, phosphorus	Soil	10 feet	4	SS, 2.5'	Table 6-6	1, 3		
PCB Storage Shed	Fig. 6-1	PCB spills	Soil	10 feet	3	SS, 2.5'	Table 6-6, PCBs			
Septic Tank Areas incl. East of FMC Electric Sign	Fig. 6-2	Sewage drainfield-nitrate plume	Soil	10 feet	4	SS, 2.5'	Table 6-6, Nitrate			
Calciner Pond Sediment Area South of Calciner Ponds	Fig. 6-1	Unlined pile-selenium plume, calciner sludge	Soil	10 feet	1	SS, 2.5'	Table 6-6	3		
Calciner Fines Area South of Calciner Ponds	Fig. 6-1	Unlined pile-selenium plume	Soil	10 feet	1	SS, 2.5'	Table 6-6	3		
Secondary Condenser/Fluid Bed Drier Area	Fig. 6-2	Phosphorus spills, leaks	Soil	10 feet	2	SS, 2.5'	Table 6-6			
Kiln (Scrubber) Overflow Pond (under silica pile)	Fig. 6-1	Old ponds-selenium, arsenic	Soil	10 feet	1	SS, 2.5'	Table 6-6	4		
				Subtotal	**24**					

Table 6-5 (Cont'd)

Potential Sources	Location	Sampling Rationale	Media	Sample Depth	No. of Locations	Sample Intervals	Analytes	Notes	Upgradient Wells	Downgradient Wells
Old Pond 7S Tree Line Area	Fig. 6-1	PCB spills	Soil	2 feet	3	SS+2'	Table 6-6, PCBs			
8S Recovery Process--WMU #4	Fig. 6-1	Spills-arsenic, TPH, PCBs	Soil	2 feet	2	SS+2'	Table 6-6, PCBs, TPH			
Area West of Mobile Shop	Fig. 6-2	Oil & Lubricant spills-PCBs, TPH	Soil	2 feet	2	SS+2'	Table 6-6, PCBs, TPH			
Long-Term Product Storage Tanks	Fig. 6-2	Phosphorus spills	Soil	2 feet	2	SS+2'	Table 6-6			
Phos Dock Area	Fig. 6-2	Phosphorus spills	Soil	Surface	2	SS	Table 6-6			
Paved Area North of Furnace Bldg. incl. Phos Dock	Fig. 6-2	Phosphorus spills	Soil	Surface	4	SS	Table 6-6			
Phossy Waste Pipeline Cleanout Areas and Intervals	Fig. 6-1	Spills-arsenic	Soil	2 feet	5	SS+2'	Table 6-6	1		
Precipitator Slurry Pipeline Cleanout Areas and Intervals	Fig. 6-1	Spills-arsenic	Soil	2 feet	5	SS+2'	Table 6-6	1,3		
				Subtotal	**25**					
Bannock Paving Areas	Not Shown	Spills, oils, deposition-TPH, PCBs	Soil	2 feet	3	SS+2'	Table 6-6, PCBs, TPH			
Rail Car Loading & Unloading Areas-BPC	Not Shown	Spills, oils, deposition	Soil	2 feet	2	SS+2'	Table 6-6, PCBs, TPH			
Rail Car Loading & Unloading Areas-FMC	Not Shown	Spills, oils, deposition	Soil	2 feet	4	SS+2'	Table 6-6, PCBs, TPH			
Shale Ore Handling Areas	Not Shown	Deposition	Soil	2 feet	6	SS+2'	Table 6-6, PCBs, TPH			
Surface Roads FMC & BPC	Not Shown	Spills, oils, deposition-TPH, PCBs	Soil	2 feet	20	SS+2'	Table 6-6, PCBs, TPH			
				Subtotal	**35**					
Water in Railroad Swale	Not Shown	Phosphorus spills	Water	Composite			Table 6-7	5		
Water Discharged to Calciner Ponds	Not Shown	Selenium plume	Water	Composite			Table 6-7	6		
IWW Ditch Discharge to Portneuf River	Not Shown	Cooling water-biocides, corrosion inhibitors	Water	Composite			Table 6-7	3,6		
Phossy Water Discharged to Phase IV Ponds	Not Shown	Phosphorus	Water	Composite			Table 6-7	2,6		
Precipitator Slurry Discharged to Pond 8E	Not Shown	Phosphorus	Slurry	Composite			Table 6-7	2,6		
Slag Pile Storage Areas	Not Shown	Spills, oils, deposition	Soil	Surface	6	NA	Table 6-6, TCLP			
Ferrophos Storage Areas	Not Shown	Spills, oils, deposition	Soil	Surface	3	NA	Table 6-6, TCLP			
IWW Ditch Sediments	Not Shown	Cooling water-biocides, corrosion inhibitors	Soil	Surface	5	NA	Table 6-6	3		
Phosphate Ore	Not Shown	Source of trace elements/radioactivity	Ore		1	NA	Table 6-6			
				Subtotal	**15**					
				Total	**110**					

Notes:
1 Risk of encountering elemental phosphorus is low.
2 Risk of encountering elemental phosphorus is high.
3 Investigated during 1990 drilling program.
4 Depth is into native soil.
5 Location composite sample.
6 Time composite sample.
7 Analytes analyzed in upgradient and downgradient well water samples.

Legend:
GW = Groundwater
SS = Surface Sample
• = Paired well, shallow and deep

Table 6-6
ANALYTICAL PARAMETERS
PHOSPHATE ORE, WASTE, SLUDGE, AND SOIL SAMPLES

I. Heavy Metals

Aluminum
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Manganese
Mercury
Molybdenum
Nickel
Selenium
Silver
Thallium
Vanadium
Zinc

II. General Mineral

Fluoride
Phosphorus (total)
Phosphorus (orthophosphate)
Elemental Phosphorous (FMC site)

II. Radioactivity

Gross Alpha
Gross Beta
Gamma Spectroscopy[a]

IV. Total Petroleum Hydrocarbons (TPH)[b]

V. Polychlorinated Biphenyls (PCBs)[b]

Aroclor 1016
Aroclor 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260

VI. Volatile Organics[b]

Chloromethane
Bromomethane
Vinyl Chloride
Chloroethane
Methylene Chloride
Acetone
Carbon Disulfide
1,1-Dichloroethene
1,1-Dichloroethane
Trans-1,2-Dichloroethene
Chloroform
1,2-Dichloroethane
2-Butanone
1,1,1-Trichloroethane
Carbon Tetrachloride
Vinyl Acetate
Bromodichloromethane
1,2-Dichloropropane
cis-1,3-Dichloropropene
Trichloroethene
Dibromochloromethane
1,1,2-Trichloroethane
Benzene
Trans-1,3-Dichloropropene
2-Chloroethylvinylether
Bromoform
4-Methyl-2-Pentanone
2-Hexanone
Tetrachloroethene
1,1,2,2-Tetrachloroethane
Tetrahydrofuran
Toluene
Chlorobenzene
Ethylbenzene
Styrene
Total Xylenes

VII. Semivolatile Organics[b]

Phenol
bis(2-Chloro-ethyl)ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Benzyl alcohol
1,2-Dichlorobenzene
2-Methylphenol

Table 6-6 (Cont'd)

VII. Semivolatile Organics (Cont'd)	
bis(2-Chloroisopropyl)ether	4,6-Dinitro-2-methylphenol
4-Methylphenol	N-Nitrosodiphenylamine
N-Nitroso-dipropylamine	4-Bromophenyl phenyl ether
Hexachloroethane	Hexachlorobenzene
Nitrobenzene	Pentachlorophenol
Isophorone	Phenanthrene
2-Nitrophenol	Anthracene
2,3-Dimethylphenol	Di-*n*-butyl phthalate
Benzoic acid	Fluoranthene
bis(2-Chloroethoxy)methane	Pyrene
2,4-Dichlorophenol	Butyl benzyl phthalate
1,2,4-Trichlorobenzene	3,3"-Dichlorobenzidine
Naphthalene	Benzo(a)anthracene
4-Chloroaniline	bis(2-Ethylhexyl)phthalate
Hexachlorobutadiene	Chrysene
4-Chloro-3-methylphenol	Di-n-octyl phthalate
2-Methylnaphthalene	Benzo(b)fluoranthene
Hexachlorocyclopentadiene	Benzo(k)fluoranthene
2,4,6-Trichlorophenol	Benzo(a)pyrene
2,4,5-Trichlorophenol	Indeno(1,2,3-c,d)pyrene
2-Chloronaphthalene	Dibenzo(a,h)anthracene
2-Nitroaniline	Benzo(g,h,l)perylene
Dimethyl phthalate	(1-methylethyl)-Benzene
Acenaphthylene	
3-Nitroaniline	**VIII. Toxicity Characteristics Leaching Procedure (TCLP)[(c)]**
Acenaphthylene	
2,4-Dinitrophenol	
4-Nitrophenol	**IX. Other**
Dibenzofuran	Nitrate[(b)]
2,4-Dinitrotoluene	pH
2,6-Dinitrotoluene	
Diethyl phthalate	
4-Chlorophenyl phenyl ether	
Fluorene	
4-Nitroaniline	

Notes:

(a) Ore, waste, and sludge samples only.

(b) Select samples will be analyzed for one or more of the following: PCBs, TPH, volatile organic compounds, semivolatile organic compounds, and nitrates. See Tables 6-5 and 6-8.

(c) Selected samples will be analyzed for the eight RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) after being subjected to the TCLP extraction procedure. See Table 6-5.

Sludge sediment from the following potential sources of contamination will also be sampled:

- Sludge/sediment in the railroad swale
- Sludge/sediment in the calciner ponds
- Sludge/sediment in the IWW ditch

One water, waste, and/or sludge sample will be collected from each of the potential sources of contamination listed above. Sludge samples will not be collected from potential sources at the FMC facility which contain elemental phosphorus (Ponds 11S to 14S, Pond 8E, Pond 9E, Pond 8S, and Pond 15S) because they present a safety hazard. EPA has recognized the valid safety concerns involved and has indicated acceptance of a commitment to sample these areas provided a safe sampling/analysis procedure can be developed. Water and wastes that are ultimately discharged to these ponds can be sampled safely at the point of generation and will thus be sampled in this manner.

Because these waters and wastes are the actual materials stored in the ponds containing phosphorus, these samples will also provide information on pond constituents although the ponds will not be sampled directly. FMC is continuing its efforts to develop a methodology for obtaining samples safely from these ponds.

The sludge and water samples will be analyzed for heavy metals, other inorganics (fluoride and phosphorus) and radioactivity, natural constituents, or characteristics of the phosphate ore. Water samples will also be analyzed for basic water quality parameters including major cations and anions. Lists of specific analytical parameters are provided in Table 6-6 and 6-7 for sludge and water samples, respectively.

Some of the FMC waters listed above have already been tested for some of the analytes listed in Table 6-7 as part of the FMC RCRA Part B application process (FMC, 1991a). Therefore, FMC samples of these waters collected in Phase I will only be analyzed for constituents for which the waters were not previously tested.

FMC potential source samples which contain elemental phosphorus may require testing by a laboratory with previous expertise in handling phosphorus-containing samples. Relevant data collected as part of the RCRA Part B process will be reported with the potential source data collected in Phase I in both the Preliminary Site Characterization and RI reports.

Analytical data from the waste samples will be compared with analytical data for groundwater and surface water samples in an attempt to assess whether one or more of the waters/wastes and/or sludges/sediments may have been or be a source of any contamination detected in the environmental media.

The potential sources listed in Table 6-5 that are active lined ponds, have a high potential safety risk because of the presence of elemental phosphorus, and/or are not accessible will not be sampled at this time. FMC is working with its consultants to develop safe methodologies for drilling, sampling, and analyzing soils and sediments containing elemental phosphorus.

For active lined ponds, FMC proposes to rely at this time on groundwater quality data from wells located upgradient and downgradient of these ponds (Section 6.5) to assess the impact of the ponds on the environment. If groundwater downgradient of these ponds is contaminated relative to groundwater upgradient, it will be assumed that one or more of these ponds is contributing to groundwater contamination. If downgradient water quality is not contaminated relative to upgradient quality, it will be necessary to develop a means of characterizing the soils beneath the ponds or of estimating the potential leakage from these ponds to evaluate the potential for future contamination of groundwater from these potential sources. Wells upgradient and downgradient from these ponds are indicated in Table 6-5. (See Section 6.5 for a discussion of these wells and their specific locations.)

Table 6-7
POTENTIAL SOURCE WATER/WASTE AND SURFACE WATER ANALYTICAL PARAMETERS

I. Heavy Metals[a]	II. Water Quality Parameters	III. Radioactivity
Aluminum	Alkalinity (bicarbonate)	Gross Alpha
Antimony	Alkalinity (carbonate)	Gross Beta
Arsenic	Ammonia	Radium-226
Barium	Calcium	Radium-228
Beryllium	Chloride	
Boron	Conductivity	
Cadmium	Dissolved Oxygen[b]	
Chromium	Fluoride	
Cobalt	Magnesium	
Copper	Nitrate	
Iron	pH	
Lead	Phosphorus (total)	
Lithium	Phosphorus (orthophosphate)	
Manganese	Potassium	
Mercury	Sodium	
Molybdenum	Sulfate	
Nickel	Temperature	
Selenium	Total Dissolved Solids	
Silver	Total Suspended Solids[b]	
Thallium		
Vanadium		
Zinc		

Notes:

(a) Both unfiltered and filtered surface water samples will be submitted for metals analysis.

(b) Surface water samples only

Borings in high phosphorus risk areas may be attempted in the a supplemental subsurface investigation program, if groundwater monitoring of these areas does not provide data adequate to delineate source areas.

6.1.1.3 Pond 8S (WMU #7)

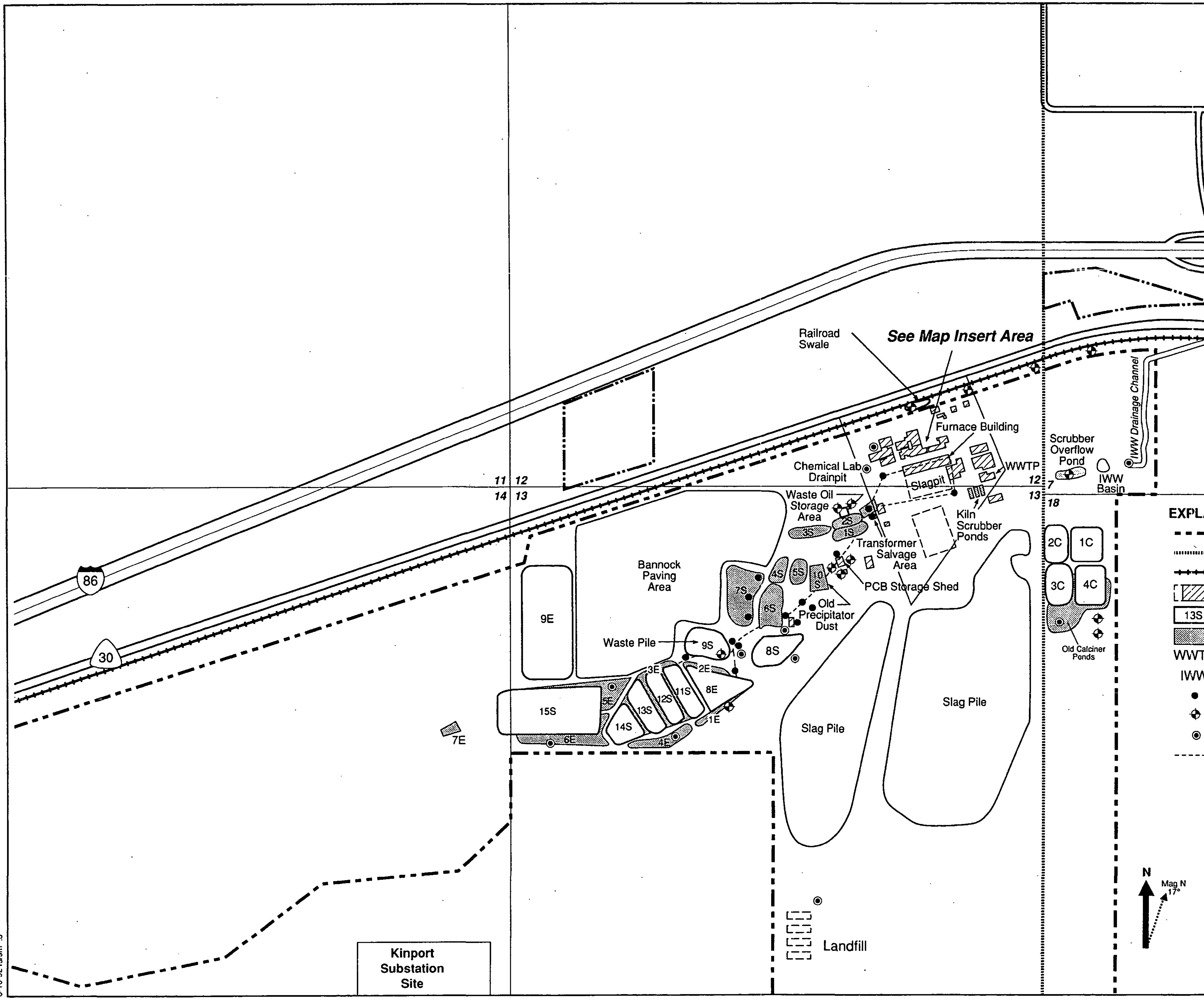
Pond 8S is an unlined pond (WMU #7) containing phossy wastes from previous operations. Three borings will be drilled around the perimeter of the pond area to characterize the soils in the vicinity of this facility. The boring locations are shown in Figure 6-1. To assess the vertical extent of any contamination which may exist in this area, soil samples will be collected at intervals of 10 feet until groundwater is encountered. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.4 Old Calciner Ponds

Old calciner ponds were in the same location as new Calciner Ponds 3C and 4C. The old ponds were removed before the new calciner ponds were constructed. The sediments and excavated soils were stored in the area south of the current calciner ponds. To assess possible soil contamination in the area of the old calciner ponds, a boring will be drilled south of existing Calciner Pond 3C. The proposed boring location is shown in Figure 6-1. To assess the vertical extent of any contamination which may exist in this area, soil samples will be collected at the ground surface, and at intervals of 10 feet until groundwater is encountered. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.5 Former Pond 4E

Former Pond 4E was located in the same general area as existing Ponds 11S through 14S. One boring will be drilled at this location to characterize the soils. The location of this boring is shown in Figure 6-1. To assess the vertical extent of contamination which may exist in this area, soil samples will be collected at the ground surface and at intervals of 10 feet until groundwater is encountered. Samples will be analyzed for the parameters in Table 6-6.



BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

FMC ONSITE SOIL SAMPLING LOCATIONS

JOB No.	DRAWING No.	REV.
21372	FIGURE 6-1	

6.1.1.6 Former Ponds 5E and 6E

Former Ponds 5E and 6E were located in the same general area as existing lined Pond 15S. The old ponds were removed from service before the new pond was constructed. Some soils data were collected at these locations and are presented in the FMC Facility Assessment (FFA). Soils in the area of these old ponds will be characterized by drilling one boring at the location of each of these former ponds. The proposed boring locations are shown in Figure 6-1. To assess the vertical extent of any contamination which may exist in these areas, soil samples will be collected at the ground surface and at intervals of 10 feet until groundwater is encountered. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.7 Active Landfill

The active landfill is located south of the slag pile. Potential impact of the active landfill on the soils in the vadose zone will be evaluated by drilling one boring in a location downgradient of this landfill. The proposed boring location is shown in Figure 6-1. To assess the vertical extent of any contamination which may exist in this area, soil samples will be collected at the ground surface and at intervals of 10 feet until groundwater is encountered or to a depth of 10 feet into rock if no groundwater is encountered. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.8 Chemical Laboratory Seepage Pit

The chemical laboratory seepage pit, located beneath the main parking lot, was used to dispose of organic and inorganic chemical wastes from the lab prior to 1980. To assess possible soil contamination in the area of the seepage pit, two borings will be drilled, one south of the seepage pit and one to the northeast. The boring locations are shown in Figure 6-1. To assess the vertical extent of any contamination which may exist in this area, soil samples will be collected at the ground surface, and at intervals of 10 feet until groundwater was encountered. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.9 Industrial Wastewater (IWW) Basin/Ditch

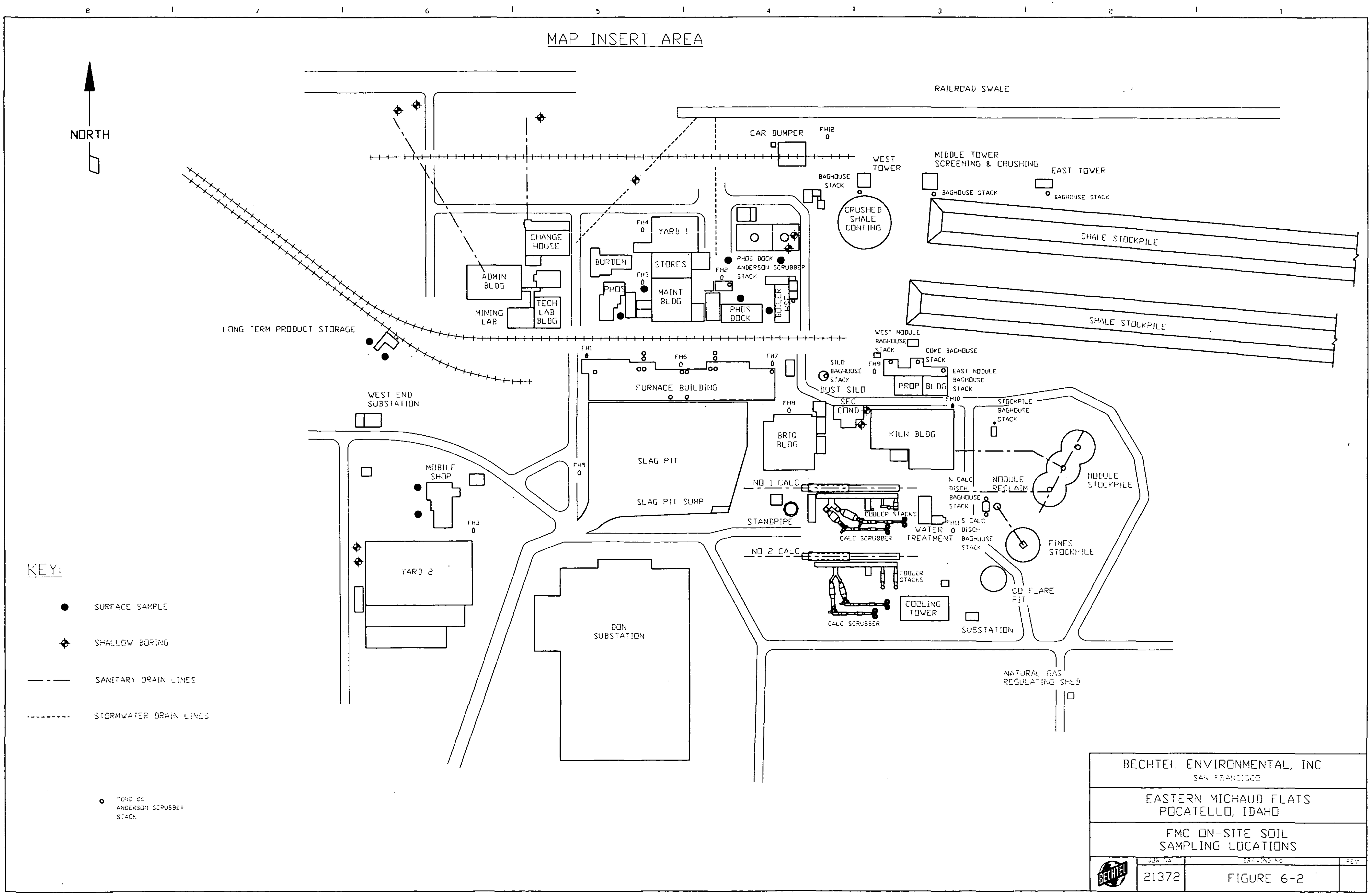
The IWW basin and ditch carry industrial wastewater from the cooling basin. Soils in the area of the IWW basin and drainage ditch will be characterized to assess the degree to which FMC non-contact waters may have contaminated soils beneath the unlined drainage ditch. A boring will be drilled near the outlet to the IWW drainage ditch. The proposed boring location is shown in Figure 6-1. Soil samples will be collected at intervals of 10 feet until groundwater is encountered to assess the vertical extent of any contamination which may exist in this area. Samples will be analyzed for the parameters in Table 6-6. Additionally, five surface samples of sediments will be collected from the IWW ditch. These samples will also be analyzed for the parameters in Table 6-6.

6.1.1.10 Boiler Fuel Tank and Pipeline Area

The boiler fuel tank contains fuel oil for operating the boilers. The tank has an approximate capacity of 20,000 gallons. To assess possible soil contamination from spills and pipeline leaks, two borings will be drilled in the area of the boiler fuel storage tanks and associated pipeline. The proposed boring locations are shown in Figure 6-2. To assess the vertical extent of any contamination which may exist in this area, soil samples will be collected at the ground surface, and at intervals of 5 feet to a total depth of 50 feet. Samples will be analyzed for TPH, and the parameters in Table 6-6.

6.1.1.11 Former Pond 1E

Former Pond 1E was located in the same general area as existing lined Ponds 8E and 11S. The old pond was removed before the new ponds were constructed. One boring will be drilled in the location of this former pond to characterize the soils in the area adjacent to the new ponds. The proposed boring location is shown in Figure 6-1. Soil samples will be collected at the ground surface and at intervals of 2.5 feet to a depth of 15 feet. Samples will be analyzed for the parameters in Table 6-6.


MAP INSERT AREA
NORTH
RAILROAD SWALE
CAR DUMPER
FH12
WEST TOWER
MIDDLE TOWER SCREENING & CRUSHING
EAST TOWER
BAGHOUSE STACK
CRUSHED SHALE CONTING
SHALE STOCKPILE
SHALE STOCKPILE
CHANGE HOUSE
YARD 1
ADMIN BLDG
BURDEN
STORES
PHOS
MAINT BLDG
PHOS DOCK
PHOS DOCK ANDERSON SCRUBBER STACK
BOILER HSE
MINING LAB
TECH LAB BLDG
FH1
FH2
FH3
FH4
FH5
FH6
FH7
FH8
FH9
FH10
FH11
LONG TERM PRODUCT STORAGE
WEST NODULE BAGHOUSE STACK
COKE BAGHOUSE STACK
SILO BAGHOUSE STACK
EAST NODULE BAGHOUSE STACK
DUST SILO
PROP
BLDG
FURNACE BUILDING
WEST END SUBSTATION
SEC COND
STOCKPILE BAGHOUSE STACK
BRIQ BLDG
KILN BLDG
SLAG PIT
SLAG PIT SUMP
MOBILE SHOP
NO 1 CALC
N CALC DISCH BAGHOUSE STACK
NODULE RECLAIM
NODULE STOCKPILE
STANDPIPE
COOLER STACKS
CALC SCRUBBER
WATER TREATMENT
S CALC DISCH BAGHOUSE STACK
FINES STOCKPILE
YARD 2
NO 2 CALC
COOLER STACKS
CO FLARE PIT
COOLING TOWER
CALC SCRUBBER
SUBSTATION
DON SUBSTATION
NATURAL GAS REGULATING SHED
KEY:
SURFACE SAMPLE
SHALLOW BORING
SANITARY DRAIN LINES
STORMWATER DRAIN LINES
POND BY ANDERSON SCRUBBER STACK
BECHTEL ENVIRONMENTAL, INC
SAN FRANCISCO
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
FMC ON-SITE SOIL SAMPLING LOCATIONS
JOB NO.
DRAWING NO.
REV
21372
FIGURE 6-2

6.1.1.12 Area 9S

Area 9S is a storage pile for dried precipitator dust. It is an unlined, excavated area covering approximately 3 acres. Soils in the Area 9S waste pile will be characterized. One boring will be drilled in the location of this former pond. The proposed boring location is shown in Figure 6-1. Soil samples will be collected at the ground surface and at intervals of 2.5 feet to a depth of 15 feet. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.13 Transformer Salvage Area

The transformer salvage area, located near inactive Pond 1S, is a storage area for used transformers. Transformers have been removed, and the area cleaned and graded. Two borings will be drilled in the location of this transformer storage area to evaluate existing soil conditions. The proposed boring locations are shown in Figure 6-2. Soil samples will be collected at the ground surface and at intervals of 2.5 feet to a depth of 10 feet. Samples will be analyzed for PCBs and the parameters in Table 6-6.

6.1.1.14 Waste Oil Storage Area

The waste oil storage area was constructed in 1990 for drummed waste oils. This storage area overlies part of old Pond 2S. Two borings will be drilled in the location of the waste oil storage area to evaluate existing soil conditions. The proposed boring locations are shown in Figure 6-1. Soil samples will be collected at the ground surface and at intervals of 2.5 feet to a depth of 10 feet. Samples will be analyzed for the parameters in Table 6-6, PCBs, and total petroleum hydrocarbons (TPH).

6.1.1.15 Railroad Swale

The railroad swale is a ditch running along the railroad tracks at the north end of the facility. This ditch is used to catch storm-water runoff. The railroad swale does not discharge to surface water. The soils in this area will be evaluated by drilling four borings to a depth of 10 feet. The proposed boring locations are shown in Figure 6-1. Soil samples will be collected at the ground surface and at intervals of 2.5 feet to a depth of 10 feet. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.16 PCB Storage Shed

The PCB storage shed is a concrete structure used to store drums of transformer oil which contain concentrations of PCBs in excess of 50 ppm. The soils in this area will be evaluated by drilling three borings to a depth of 10 feet. The proposed boring locations are shown in Figure 6-1. Soil samples will be collected at the ground surface and at intervals of 2.5 feet to a depth of 10 feet. Samples will be analyzed for PCBs and the parameters in Table 6-6.

6.1.1.17 Septic Tank Areas

The FMC plant uses septic tanks and drainfields for disposal of sanitary sewage. Two large drainfields serve the administration building and did serve the main change house. In 1990 the change house was connected to the Pocatello POTW. There are also seven drainfields for the main plant. Four borings will be drilled in the septic tank areas to evaluate existing soil conditions. The proposed boring locations are shown in Figure 6-2. Soil samples will be collected at the ground surface and at intervals of 2.5 feet to a depth of 10 feet. Samples will be analyzed for nitrates and the parameters in Table 6-6.

6.1.1.18 Calciner Pond Sediment and Calciner Fines Areas

This is the area where calciner fines and sediments from the current ponds are being stored. Calciner fines from the old calciner ponds were placed on land south of the calciner pond area and allowed to dry. The treated calciner pond sludge from existing Calciner Pond 1C was placed on land south of the calciner fines area and allowed to dry for several months. Two borings will be drilled in the these areas to evaluate existing soil conditions. The proposed boring locations are shown in Figure 6-1. Soil samples will be collected at the ground surface and at intervals of 2.5 feet to a depth of 10 feet. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.19 Secondary Condenser/Fluid Bed Drier

The secondary condenser is used to remove elemental phosphorus from the furnace exhaust gases. It is in the same location as the old fluid bed drier unit. The fluidized bed drier was used in the early 1980s to dry and oxidize precipitator slurry, removing elemental phosphorus. The soils in this area will be evaluated by drilling two borings to a depth of 10 feet. The proposed boring locations are shown in Figure 6-2. Soil samples will be collected at the ground surface and at intervals of 2.5 feet to a depth of 10 feet. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.20 Kiln Scrubber and Overflow Pond

Three kiln scrubber ponds, located under existing Calciner 2, were used to hold kiln scrubber blowdown in the past. The ponds were excavated and the wastes removed before the calciner was constructed in 1966. Soils in this area will be evaluated by drilling one boring to a depth of 10 feet. The proposed boring location is shown in Figure 6-1. Soil samples will be collected at the ground surface and at intervals of 2.5 feet to a depth of 10 feet. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.21 Old Pond 7S Tree-Line Area

Old Pond 7S was closed and covered in place. Ferrophos prills have been placed in this area for storage. This area is a potential source of PCBs and metals due to its use as a storage area. Three borings will be drilled in the this area to evaluate existing soil conditions. The proposed boring locations are shown in Figure 6-1. Soil samples will be collected at the ground surface and at a depth of 2 feet. Samples will be analyzed for PCBs and the parameters in Table 6-6.

6.1.1.22 8S Recovery Process (WMU #4)

The 8S recovery process (WMU #4) was built in 1983 and operated as a test facility to recover elemental phosphorus from Pond 8S. The processing equipment is located on a concrete pad within a dike near Pond 8S. Two borings will be drilled in the this area to evaluate existing soil conditions. The proposed boring locations are shown in Figure 6-1. Soil samples will be collected at the ground surface and at a depth of 2 feet. Samples will be analyzed for the parameters in Table 6-6, PCBs, and TPH.

6.1.1.23 Area West of Mobile Shop

The area west of the mobile shop was used to store and maintain equipment, fuel, motor oil, and lubricants. Soils in this area will be evaluated by collecting samples in two locations to a depth of 2 feet. The proposed sample locations are shown in Figure 6-2. Soil samples will be collected at the ground surface and at a depth of 2 feet. Samples will be analyzed for the parameters in Table 6-6, PCBs, and TPH.

6.1.1.24 Long-Term Product Storage Tanks

FMC uses several tanks to store elemental phosphorus on the south side of a railroad spur west of the furnace building. Soils in this area will be evaluated by sampling at two locations to a depth of 2 feet. The proposed sample locations are shown in Figure 6-2. Soil samples will be collected at the ground surface and at a depth of 2 feet. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.25 Phos Dock Area (Paved)

Elemental phosphorus is handled in the paved phos dock area, and historically this is where most of the reportable spills have occurred. Soils in this area will be evaluated by collecting surface samples in two locations. The proposed sampling locations are shown in Figure 6-2. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.26 Paved Area Between Phos Dock and Furnace Building

The area between the phos dock and the furnace building is where the elemental phosphorus is loaded into railroad cars. Soils in this area will be evaluated by collecting surface samples in four locations. The proposed sampling locations are shown in Figure 6-2. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.27 *Phossy Waste Pipeline and Precipitator Slurry Pipeline Cleanouts*

The phossy waste and phossy water are pumped from the furnace washdown collection tank and the phos dock via pipelines to the Phase IV ponds. Precipitator slurry is pumped from the furnace building via pipelines to Pond 8E. Because of the high solids content and the physical state of the elemental phosphorus, cleanout taps are located along the pipelines at locations where solids may tend to accumulate such as where the pipelines bend or change direction. Soils in the pipeline cleanout areas will be evaluated by sampling ten locations to a depth of 2 feet. The proposed sample locations are shown in Figure 6-1. Soil samples will be collected at the ground surface and at a depth of 2 feet. Samples will be analyzed for the parameters in Table 6-6.

6.1.1.28 *Bannock Paving Company Areas*

The Bannock Paving Company leases land from FMC in the north central portion of the FMC property. Slag, coke, and other materials are stored throughout the leased property. Soil samples will be collected at five locations throughout the leased property. At each sample location, samples will be collected at the ground surface and at a depth of 2 feet. Samples will be analyzed for the parameters listed in Table 6-6, TPH, and PCBs.

6.1.1.29 *Rail Car Loading and Unloading Areas*

FMC receives shale ore by rail car during the spring, summer, and fall months. The shale ore is dumped into a below ground hopper. FMC loads specially designed rail cars with elemental phosphorus. Bannock Paving Company receives coke by rail car. The coke is unloaded into a storage pile. Bannock Paving Company also loads crushed ferrophos and slag into rail cars. Soil samples will be collected at a total of six locations for the FMC and Bannock Paving Company rail car loading and unloading facilities. At each sample location, samples will be collected at the ground surface and at a depth of 2 feet. Samples will be analyzed for the parameters listed in Table 6-6, TPH, and PCBs.

6.1.1.30 Shale Ore Handling Areas

At FMC, the shale ore is dumped into a below-ground hopper where it is placed on the stockpile by conveyors and specialized equipment. It is reclaimed from the stockpile using similar material handing equipment, crushed, and transported to the briquetting building. Other material handling equipment and conveyors are used to move the coke and silica to the proportioning building. To assess the extent of contamination from shale ore handling facilities, soil samples will be collected at six locations. At each sample location, samples will be collected at the ground surface and at a depth of 2 feet. Samples will be analyzed for the parameters listed in Table 6-6, TPH, and PCBs.

6.1.1.31 Surface Roads

There are over 15 miles of surface roads in the FMC and Bannock Paving Company plant sites. To assess the extent of contamination of roads throughout the site, due to the application of oils and dust suppressants throughout the facility's history, soil samples will be collected at approximately 20 locations throughout the facility. At each sample location, samples will be collected at the soil surface (i.e., below pavement or slag where they exist) and at a depth of 2 feet. Samples will be analyzed for the parameters listed in Table 6-6, TPH, and PCBs.

6.1.1.32 Slag Pile Storage Area

Slag, a byproduct of furnace operations, is stored on site in large piles. The slag piles are located south of the plant operations areas. Surface soil samples will be collected at six locations. Samples will be analyzed for the parameters listed in Table 6-6, and TCLP metals analyses will also be done.

6.1.1.33 Ferrophos Storage Areas

Ferrophos is an iron-rich byproduct of furnace operations which is collected in sand molds and stored on site until sold and shipped. To assess the extent of contamination which may have occurred at the site due to ferrophos storage, surface soil samples will be collected at three locations. Samples will be analyzed for the parameters listed in Table 6-6, and TCLP metals analyses will also be done.

6.1.1.34 Areas Not Further Characterized/Sampled During Phase I

The following areas will not be further characterized or sampled during Phase I of the RI. Data developed from the subsurface soils and groundwater investigations described in Sections 6.4 and 6.5, and from nearby sampling in these investigations, will be used to evaluate the need for additional data in these areas. If additional data are required for the potential source investigations, a program of investigations, will be prepared and submitted to the EPA for its review and approval.

Materials in the ponds are inaccessible because they are overlain by other currently active ponds or other facility structures, or they contain phosphorus. It should be noted that FMC's operational processes are basically the same although the facility has been in operation for more than 40 years. Wastes currently generated are not expected to vary significantly from those generated previously. Thus, the concentrations of FMC wastes discharged to existing active ponds are expected to be similar to concentrations in inactive ponds. The slag pile and the landfills will be monitored by wells.

- <u>Ponds 11S through 14S.</u> These are lined (single liner) ponds in active use.
- <u>Ponds 15S, 8E, 9E, 1C, 2C, 3C, and 4C</u>. These ponds are in active use, double lined, and have leachate collection systems.
- <u>Old Precipitator Slurry Ponds (Ponds 00S, 0S, 1S through 7S, and 10S).</u> The locations of old Ponds 00S and 0S are inaccessible. Ponds 1S and 2S were dried and covered with slag in 1972; their locations are inaccessible. Ponds 3S, 4S, and 5S were dried and covered with 3 to 6 feet of dirt in 1976. Pond 6S was dried and covered with dirt and slag in 1980. Pond 7S was closed and covered. Pond 10S was dried and crusted over, but is still in place. These ponds are inactive and inaccessible due to possible buried pockets of elemental phosphorus that could be exposed should these ponds be investigated. Safe methods of sampling in areas of high risk of encountering elemental phosphorus are currently being evaluated.

- Old Phossy Water Ponds (2E, 3E, and 7E). The sediments in Pond 2E were excavated and placed in Pond 4E prior to the construction of Pond 8E (WMU #11) on this site. The sediments in pond 3E were also excavated prior to the construction of the Phase IV ponds (WMU #8) on this site. Pond 7E was dried in 1981.
- Slag Pit Wastewater Collection Sump. The slag pit wastewater collection sump (WMU #5) is a small area (approximately 10 feet by 10 feet) in the southeast corner of the slag pit where phossy water from the furnace area was collected and pumped to the Phase IV ponds. In 1991 this was replaced by the furnace wastewater collection tank.
- Slag Pile. The slag piles are in active use. TCLP/metals tests will be performed on samples of the slag (see Section 6.2.1.32), and the groundwater downgradient is being monitored by several wells.
- Kiln Scrubber Ponds. These ponds were excavated and removed to prepare the site and foundation for the No. 2 calciner.
- Inactive Landfills. This landfill was located within the area of the existing slag pile and is inaccessible.

6.1.2 Simplot Sources

Potential sources of contamination originating at the Simplot facility are listed in Table 6-8 and described in Section 4.

6.1.2.1 Phosphate Ore Slurry

Phosphate ore slurry, a primary ingredient in the production of phosphoric acid at the Simplot facility, is the material from which the variety of trace elements found in Simplot wastes are originally derived. Consequently, a composite sample of the ore slurry will be collected and filtered, and the solid portion of the sample will be analyzed for the parameters in Table 6-6 to confirm the appropriateness of the analytical parameter list.

Table 6-8 (Cont'd)

Potential Source	Location	Sampling Rationale	Media	Sample Depth	No. of Locations	Sample Intervals	Analytes	Upgradient Wells	Downgradient Wells
Former #1 Sulfuric Plant	Figure 6-4	Plant leakage	Soils	10 feet	2	2.5'	Table 6-6		
Former #2 Sulfuric Plant	Figure 6-4	Plant leakage	Soils	10 feet	2	2.5'	Table 6-6		
Phosphoric Acid Tank Containment	Figure 6-4	Tank leakage	Soils	10 feet	2	2.5'	Table 6-6		
Cooling Tower Area	Figure 6-4	Cooling tower spray/leakage	Soils	10 feet	2	2.5'	Table 6-6		
Former Cooling Pond	Figure 6-4	Pond water migration	Soils	10 feet	2	2.5'	Table 6-6		
Water Reclaim Area	Figure 6-4	Pipe/pump leakage	Soils	2 feet	2	SS+2'	Table 6-6		
Former Ore Pile Area	Figure 6-4	Residual ore	Soils	2 feet	5	SS+2'	Table 6-6		
Salvage and Storage Area	Figure 6-4	Answer persistent questions	Soils	2 feet	3	SS+2'	Table 6-6, PCBs, TPH		
Roads (paved, unpaved, slag covered)	Now Shown	Dust suppressant application	Soils	2 feet	See text	SS+2'	Table 6-6, PCBs, TPH		
				Subtotal	**54**				
Irrigation Water	Not Shown	Trace elements		Composite	1	NA	Table 6-7, 6-12	512, 513	508-511
				Subtotal	**159**				
				Total	**159**				

Legend:
GW = Groundwater
SS = Surface Sample

Table 6-8
SIMPLOT POTENTIAL SOURCE INVESTIGATION

Potential Source	Location	Sampling Rationale	Media	Sample Depth	No. of Locations	Sample Intervals	Analytes	Upgradient Wells	Downgradient Wells
Ore Slurry	Now Shown	Trace elements	Slurry	Composite	1	NA	Table 6-6		
Gypsum Slurry	Now Shown	Trace elements	Slurry	Composite	1	NA	Table 6-6		
Pond Waters	Not Shown	Trace elements		Composite	4	NA	Table 6-7		
Pond Sediments	Not Shown	Trace elements		Composite	4	NA	Table 6-6		
Gypsum Stacks	Figure 6-3	Gypsum water migration	Soils	to GW	6	10'	Table 6-6, 6-12	301-304, PEI-1	300, 305-307,
									313, 314, 321,
									PEI-4, PEI-6
Unlined Ditch to Water Treatment Ponds	Figure 6-4	Ditch water migration	Soils	2 feet	6	SS+2'	Table 6-6		
East Overflow Pond	Figure 6-4	Pond water migration	Soils	to GW	1	10'	Table 6-6, 6-12	315, 316	317, 318
Water Treatment Ponds:							Table 6-12	319, 320	503-505
Holding Pond (Active)									
Settling Pond (Active)	Figure 6-4	Pond water migration	Soils	to GW	1	10'	Table 6-6		
Equalization Pond (Active)									
Dewatering Pit	Figure 6-4	Pit water migration	Soils	to GW	1	10'	Table 6-6, 6-12	319, 320	503-505
				Subtotal	**25**				
Former Pillow Tank Area	Figure 6-4	Tank leakage	Soils	10 feet	2	2.5'	Table 6-6		
Loadout Areas (soils):	Figure 6-4	Product spillage	Soils						
Ammonium Phosphate #1 (solid)									
Rail				2 feet	2	SS+2'	Table 6-6		
Truck and Front End Loader				2 feet	6	SS+2'	Table 6-6		
Ammonium Phosphate #2 (solid)									
Rail				2 feet	2	SS+2'	Table 6-6		
Truck and Front End Loader				2 feet	6	SS+2'	Table 6-6		
Ammonium Sulfate (solid)									
Rail				2 feet	2	SS+2'	Table 6-6		
Truck				2 feet	2	SS+2'	Table 6-6		
Triple Superphosphate (solid)									
Rail				2 feet	2	SS+2'	Table 6-6		
Truck				2 feet	2	SS+2'	Table 6-6		
Phosphoric Acid (liquid)									
Truck				10 feet	2	2.5'	Table 6-6		
Former Phosphoric Acid (liquid)/Rail Car Cleaning									
Rail				10 feet	2	2.5'	Table 6-6		
Sulfuric Acid (liquid)									
Rail				10 feet	2	2.5'	Table 6-6		
Truck				10 feet	2	2.5'	Table 6-6		

6.1.2.2 *Waters and Wastes*

Waters and/or wastes from the Simplot facility discharged to active units, such as ponds, will be collected and analyzed. The only process streams that will be tested are those that pose or have historically posed a potential substantial threat to the environment (i.e., streams that have the potential to exit to the environment via direct discharge or percolation). For Simplot, these streams are the water discharged to the water treatment ponds, the water in the east overflow pond, and the gypsum slurry discharged to the gypsum stacks. A 24-hour composite sample will be collected from each of the process streams mentioned above to confirm historical data on the content of these streams.

A sludge sample will also be collected from each of Simplot's ponds (east overflow pond and the three water treatment ponds) and from the dewatering pit. The water, waste, and sludge samples will be analyzed for inorganics and radioactivity, natural constituents, or characteristics of the phosphate ore which is the primary raw material feed to processes at the two facilities. Water samples will also be analyzed for basic water quality parameters including major cations and anions. Lists of specific analytical parameters are provided in Tables 6-6 and 6-7 for waste/sludge and water samples, respectively.

6.1.2.3 *Gypsum Stacks*

In addition to sampling and testing of the gypsum slurry as described above, soil beneath the gypsum stacks will be characterized. Two borings will be drilled through the top of the northernmost gypsum stack to groundwater. Four borings will be drilled through the top or north face of the southernmost gypsum stack to groundwater. Proposed boring locations are shown on Figure 6-3. Beginning at the interface between the gypsum and native soil, soil samples will be collected every 10 feet to assess the potential vertical extent of contamination. Samples will be analyzed for the parameters in Table 6-6.

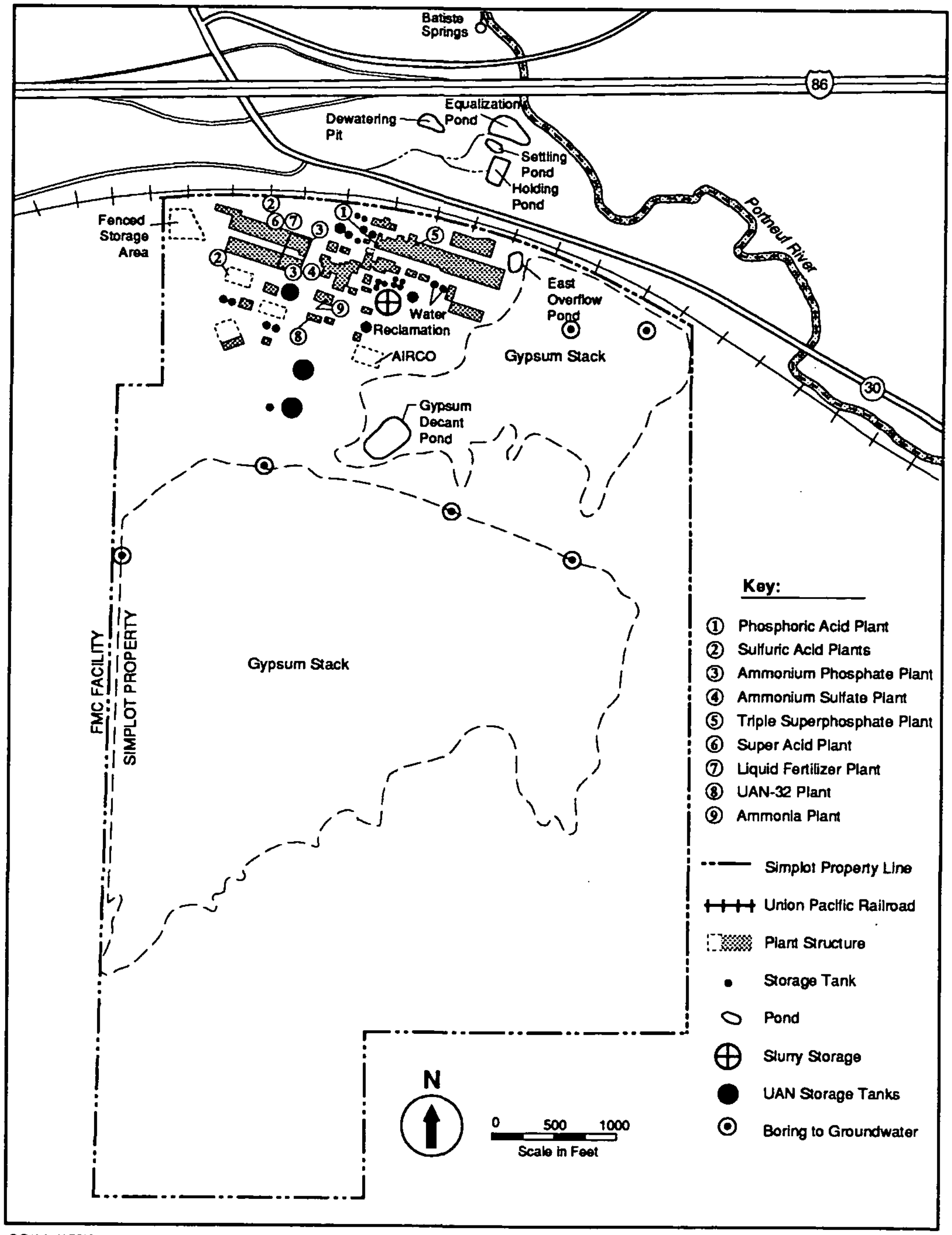


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Figure 6-3 Gypsum Stack Boring Locations

6.1.2.4 *Unlined Ditch to Water Treatment Ponds*

To assess the degree to which Simplot non-contact waters may have contaminated soils beneath the unlined drainage ditch, soil will be sampled at six locations along the ditch as indicated in Figure 6-4. At each sample location, samples will be collected at the bottom of the ditch and approximately 2 feet below the ditch bottom. The samples will be analyzed for the parameters in Table 6-6. Given the relatively low hydraulic head in the ditch, contaminants are not likely to have migrated more than a few feet beneath the the bottom of the ditch. If, however, contamination is detected in samples from the surface and 2-foot depth, additional sampling will be proposed in Phase II to further define the vertical extent of contamination.

6.1.2.5 *East Overflow Pond*

To assess the extent of potential soil contamination beneath the east overflow pond, a soil boring will also be drilled from the bottom of the pond to groundwater. A soil sample will be collected at the interface between pond sludges and native soil and every 10 feet thereafter. Samples will be analyzed for the parameters in Table 6-6. The Idaho Department of Environmental Quality has expressed reservations about drilling through the hardened gypsum at the bottom of the pond because the gypsum has formed a relatively impermeable layer which may slow the vertical migration of contaminants from the pond. To address this reservation, every effort will be made to "reseal" the pond when backfilling the boring with grout. In addition, Simplot will attempt to delay drilling of this boring until use of the pond will no longer be required. (Simplot currently plans to install a lined replacement pond in the latter part of 1992.)

6.1.2.6 *Water Treatment Ponds*

Because the water treatment ponds are active, lined, or sealed units, it is not practical to sample the soils immediately beneath the ponds to assess the vertical extent, if any, of contamination due to pond leakage. Therefore, Simplot proposes to rely at this time on groundwater quality data from wells located upgradient and downgradient of the ponds (Section 6.5) to assess the impact of the ponds on the environment. If groundwater downgradient of the ponds is contaminated relative to groundwater upgradient of the ponds, it will be assumed that one or more of the ponds is contributing to groundwater contamination. If downgradient groundwater quality is not contaminated relative to upgradient quality, it will still be necessary to evaluate the potential for future contamination of groundwater. The evaluation will require development of some means of characterizing soils beneath the ponds or of estimating the potential leakage from the ponds. Wells located upgradient and downgradient of the ponds are indicated on Table 6-8. (See Section 6.5 for discussion of the wells and their specific locations.)

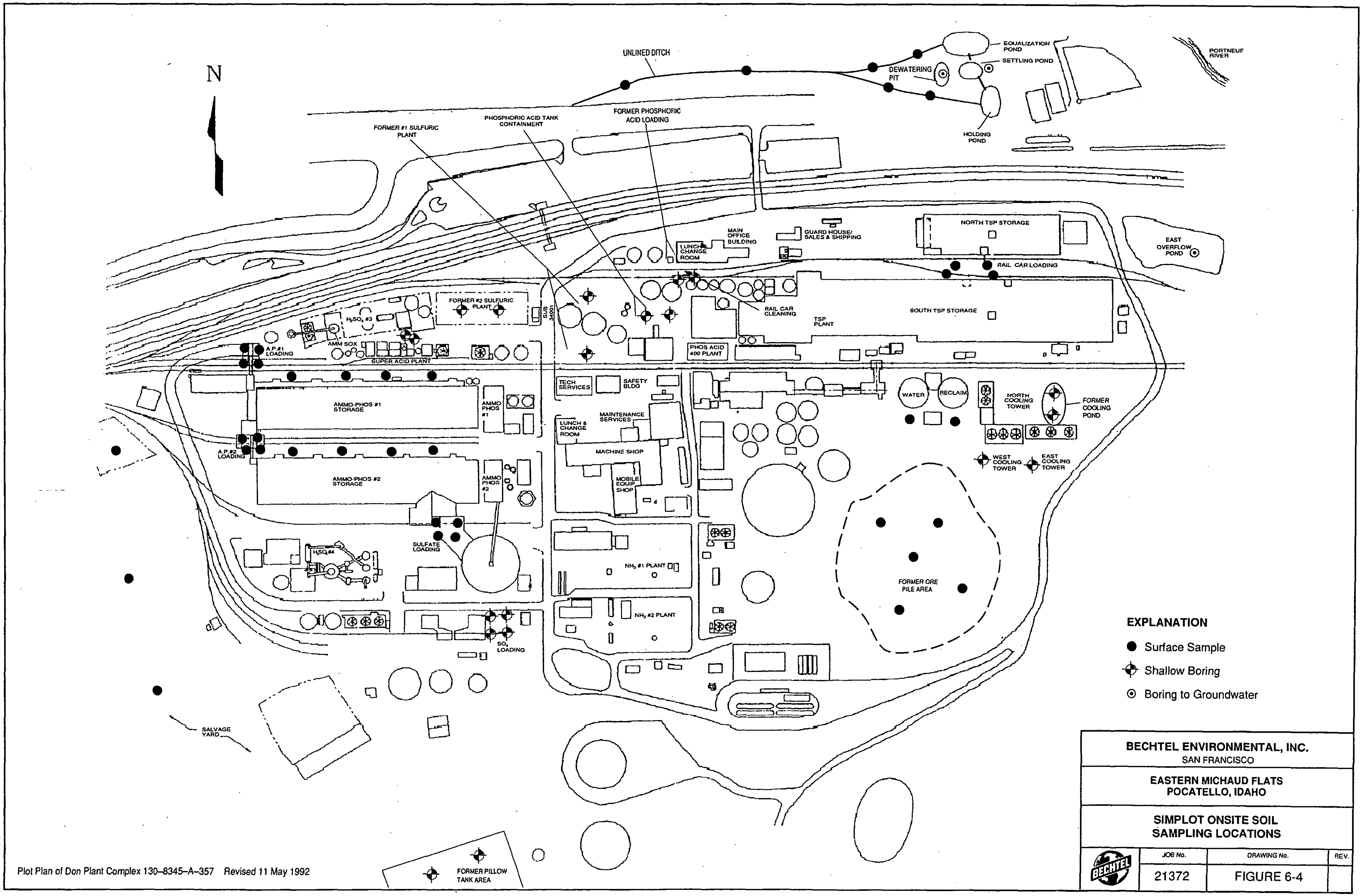
The settling pond was at one time approximately twice its current size, occupying its current location and the area immediately to the east. For this reason, a boring will be drilled to groundwater immediately east of the current pond as a substitute for sampling soils beneath it. Because the water transferred to the settling pond is of essentially the same quality as water transferred to the holding pond and of poorer quality than water which enters the equalization pond, soil samples collected in this boring should provide a relatively conservative estimate of any soil contamination which may have occurred as a result of leakage from the three ponds. A sample will be collected at the surface and at 10-foot intervals thereafter. Samples will be analyzed for the parameters listed in Table 6-6.

6.1.2.7 Dewatering Pit

To assess the extent of contamination beneath the dewatering pit, a soil boring will be drilled from the bottom of the pit to groundwater. A soil sample will be collected at the interface between pond sludges and native soil and every 10 feet thereafter. Samples will be analyzed for the parameters in Table 6-6.

6.1.2.8 Former Pillow Tank Area

Among the plant operational areas where Simplot knows spillage or leakage of plant ingredients and/or products has occurred is the area now known as the former



BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

SIMPLOT ONSITE SOIL SAMPLING LOCATIONS

FIGURE 6-4

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pillow tank area. (See Figure 6-4.) Until 1991, Simplot stored phosphoric acid and UAN-32 (urea and ammonium nitrate) products in thirteen 200,000-gallon pillow, or hypalon tanks in a series of cells carved out of native soils to a depth of approximately 8 feet. To assess the extent of any soil contamination resulting from leakage from these tanks, two borings will be drilled through the former pillow tank area as indicated in Figure 6-4. Samples will be collected at the bottom of the cells to a depth of approximately 10 feet below the cells at intervals of approximately 2.5 feet. Samples will be analyzed for the parameters in Table 6-6. Contaminants are not likely to have migrated more than 10 feet below the cell bottoms because tank leakage in this area was intermittent and, therefore, there was rarely a significant driving force for the movement of phosphoric acid or UAN 32 products, and their trace constituents, downward through the soils. If, however, contamination is detected to a depth of 10 feet below the cell bottoms, sampling will be performed at deeper intervals in the next phase to assess the maximum vertical extent of contamination.

6.1.2.9 Loadout Areas

Among other plant operational areas where Simplot knows spillage has and does occur are the loadout areas for the facility's various products. The loadout areas fall into two categories: solid product and liquid product areas. Sampling of soils in these areas will be conducted to assess the extent of soil contamination resulting from loadout activities.

In solid product loadout areas, all of which are currently paved and serve both truck and rail, soil samples will be collected at two locations in the area of truck loading and two locations in the area of railcar loading. Given the absence of any driving force other than natural precipitation for the movement of the solid products and their trace constituents through the soils, samples will only be collected immediately below the paved surface and at a depth approximately 2 feet below the interface of pavement and soil. Samples will be analyzed for the parameters in Table 6-6. If contamination is detected at the soil surface and/or at depth, additional sampling will be required at new locations and/or at greater depths in the next phase to assess both the vertical and horizontal extent of contamination.

Simplot produces three solid products: ammonium phosphate, ammonium sulfate (sulfate) and triple superphosphate. There are two ammonium phosphate loadout areas. The two ammonium phosphate loadout areas (see areas labelled A.P. #1 and A.P. #2) and the sample locations planned in these areas are shown in Figure 6-4. The sulfate and triple superphosphate loadout areas and corresponding sample locations are also shown in Figure 6-4.

In addition to sampling in the solid product loadout areas, samples will be collected at four locations along the north sides of each of the ammonium phosphate storage buildings (see Figure 6-4). Front-end loaders move along the north sides of these buildings carrying reclaim product from the ammonium phosphate production areas, losing some product along the way. These areas are also paved. For the same reasons given above for the loadout areas themselves, samples will be collected along the north sides of the two buildings immediately below the pavement and at a depth of approximately 2 feet. Approximate sample locations are shown on Figure 6-4. These samples will also be analyzed for the parameters in Table 6-6.

Simplot produces two liquid products: phosphoric and sulfuric acid. As with the solid loadout areas, loadout areas for these two liquid products are paved. The locations of these loadout areas are indicated in Figure 6-4 along with the location of a former phosphoric acid loading area, more recently used for railcar cleaning. (The phosphoric acid loadout area is located between the building labelled Super Acid Plant and the Sulfuric Acid Plant #3.) Because of the ability of the liquid products to percolate down through soils, soil sampling in these areas will extend to a depth of 10 feet. Soil samples will be collected immediately below any paved surface and at 2.5-foot intervals thereafter.

In the phosphoric acid truck loadout area, samples will be collected at two locations. No soil samples will be collected in the rail loadout area located south of the super acid plant area because there are metal spill pans beneath the tracks which have been present since the inception of activities in this area. Samples will be collected at two locations in both the truck and rail portions of the sulfuric acid loadout area. Samples will also be collected at two locations in the former phosphoric acid loadout area which was only served by rail. Approximate sample locations are shown in Figure 6-4.

All soil samples collected from the liquid loadout areas will be analyzed for the parameters in Table 6-6. Contamination at depths greater than 10 feet is not expected because there are only intermittent driving forces (the liquids themselves) for the vertical migration of contaminants in these areas. However, if contamination is detected in shallow samples and/or at depth, additional sampling will be required at new locations and/or greater depths in the next phase to assess the vertical and horizontal extent of contamination.

6.1.2.10 Former Sulfuric Acid Plants

Other Simplot facility areas where spillage is known to have occurred include the areas in which the former No. 1 and No. 2 sulfuric acid plants were located (see Figure 6-4). Soils will initially be sampled at two locations in each of these areas as indicated in Figure 6-4. Using the same rationale provided for borings in the loadout areas, borings will be drilled at each of the locations in the former sulfuric plants areas to a depth of 10 feet. At each location, samples will be collected at the soils surface and at 2.5-foot intervals thereafter. Samples will be analyzed for the parameters in Table 6-6. If soil contamination is detected in this area, additional sampling will be required in the next phase to further define the horizontal and vertical extent.

6.1.2.11 Phosphoric Acid Containment

Another area of known liquid product spillage or leakage is the phosphoric acid containment area indicated on Figure 6-4. Any leakage from phosphoric acid tanks or pipes in this area flows over a paved surface to a concrete sump from which it is pumped back to the phosphoric acid reactor or filter. Soil will be sampled at two locations in this area as indicated in Figure 6-4. Using the same rationale provided for the liquid loadout areas, borings will be drilled at both locations to a depth of 10 feet. A sample will be collected immediately beneath the pavement and at 2.5-foot intervals thereafter. Samples will be analyzed for the parameters in Table 6-6. If soil contamination is detected in this area, additional sampling will be required in the next phase to define the horizontal and vertical extent of contamination.

6.1.2.12 Cooling Tower and Former Cooling Pond Area

Saturation of soils occurs in the vicinity of Simplot's cooling towers owing to spray or condensation of reclaim water from the towers. Such soil saturation also resulted from Simplot's former operation of an unlined cooling pond. (See Figure 6-4 for locations of cooling towers and former cooling pond.) For this reason, soils will be sampled in the vicinity of the towers and in the area of the former pond at the locations indicated in Figure 6-4. Using the same rationale provided for soil sampling in the liquid loadout areas, borings will be drilled at each location to a depth of 10 feet. Samples will be collected at the soil surface and at 2.5-foot intervals thereafter. The samples will be analyzed for the parameters listed in Table 6-6. If soil contamination is detected in this area, additional sampling will be required in the next phase to define the horizontal and vertical extent of contamination.

6.1.2.13 Water Reclaim Area

Some wetting of soils occurs in the water reclaim area as a result of pump thickner and pipe leakage. For this reason, samples will be collected at two locations in the water reclaim area as indicated in Figure 6-4. Samples will be collected at the soil surface and at a depth of approximately 2.5 feet. Samples will be analyzed for the parameters listed in Table 6-6. If contamination is found at one or more locations in this area, additional soil sampling will be required in the next phase to assess the extent of contamination.

6.1.2.14 Former Ore Pile Area

Prior to the completion of Simplot's phosphate ore slurry pipeline, dry phosphate ore was brought to the facility by rail and stockpiled in the area labelled former ore pile on Figure 6-4. To assess whether there is any residual contamination of soils in this area as a result of the pile, surface soil samples will be collected at five locations within the area. Given the absence of any driving force other than natural precipitation for the movement of residual phosphate ore and its trace constituents through the soils, samples will only be collected at the surface and at a depth of approximately 2 feet. Samples will be analyzed for the parameters in Table 6-6. If contamination is detected at the soil surface and/or at depth, additional sampling will be required at new locations and/or at greater depths in the next phase to assess both the vertical and horizontal extent of contamination.

6.1.2.15 Salvage and Storage Area

Although Simplot has no records of any particular spillage or leakage in the facility's salvage and storage area, soil samples will be collected at three locations in this area because of the possibility of contamination given the myriad of items that have been stored there. Samples will initially be collected at the soil surface and at a depth of approximately 2 feet. Samples will be analyzed for the parameters listed in Table 6-6 as well as for TPH and PCBs. If contamination is found at one or more locations in this area, additional soil sampling will be required in the next phase to assess the extent of contamination.

6.1.2.16 Roads

To assess the extent of potential contamination of roads throughout the Simplot facility due to the application of oils and dust suppressants throughout the facility's history, soil samples will be collected along the roads at approximately 500-linear-foot intervals. Most of the roads are paved, although some sections are unpaved and/or covered with slag. At each sample location, samples will be collected at the soil surface (i.e., below pavement or slag where they exist) and at a depth of approximately 2 feet. The samples will be analyzed for TPH and PCBs in addition to the parameters listed in Table 6-6.

6.1.2.17 Irrigation Water

To characterize the Simplot water treatment pond effluent which is sold for irrigation, a 24-hour composite of the effluent will be collected and analyzed for the parameters listed in Table 6-7. In addition, groundwater monitoring wells will be installed upgradient and downgradient of the Swanson property (Figure 2-7), a parcel to which a mixture of the Simplot effluent, water from the Fort Hall Canal, and water from the Portneuf River is applied (i.e., the mixture applied to this property does not contain sewage treatment plant effluent from the City of Pocatello). These wells and the sampling and analysis of water from these wells are described in Section 6.5. If water quality data from these wells suggests that the Simplot irrigation water is adversely impacting groundwater, additional sampling and/or the installation of monitoring wells upgradient and downgradient of other irrigated parcels will likely be required. The depth to groundwater at the Swanson property is less than the depth to groundwater at any of the other properties to which Simplot irrigation water is applied.

6.1.3 Data Analysis

Data obtained from the field investigations described in Sections 6.1.1 and 6.1.2, along with the data from the subsurface soil and groundwater investigations described in Sections 6.4 and 6.5, will be integrated into the conceptual model of the site described in Section 4. The conceptual model will be updated and revised as the data are obtained from the field and the results verified. The database that is being established will be compatible with the format requested by the EPA.

At the completion of the Phase I investigations, the database will be evaluated to determine if sufficient data have been collected to delineate potential source areas sufficiently to meet the objectives required for evaluation of candidate remedial technologies. The data analysis will be coordinated with the development of candidate remedial technologies. If additional data are needed to complete the evaluations, a Phase II investigation program will be developed in consultation with the EPA to obtain the required additional data.

Characterization of potential source areas will be developed using both plan and vertical section plots showing distributions of chemical data from soil samples collected and analyzed in the investigation programs, physical properties of the subsurface materials, and groundwater levels and gradients. Analyses of the impact of these potential source areas on the groundwater resources in the vicinity of the site will be evaluated using two-dimensional and possibly three-dimensional flow and transport models. The model(s) used will be selected on the basis of suitability for the conditions represented by the site data and the analyses to be performed. The model(s) selected will be one that is widely used for the analyses to be performed and accepted by the regulatory agencies.

6.2 AIR INVESTIGATION

The air investigation at the EMF site presents several unusual features not typically found at an NPL site:

- FMC and Simplot facilities are operating facilities with air emissions already regulated by federal and state permits. In addition, the diverse nature of the source types found at both the FMC and Simplot facilities (point, area, line, and volume sources), differs from the more usual ground level area source typical of most NPL sites.
- An extensive ongoing and historical database of air quality monitoring levels and meteorological data taken onsite and offsite at several locations.

These factors require a modified approach to the air investigation. To assess whether air is a significant migration pathway for contaminants originating from the facilities, all existing air quality, emissions and meteorological data related to the facilities and surrounding areas collected by FMC and/or Simplot as well as the EPA, National Weather Service (NWS), and the Idaho Division of Environmental Quality will be assembled, reviewed, and summarized. These data will serve as the basis for input to a comprehensive atmospheric dispersion modeling analysis. The dispersion modeling analysis will be used in two major ways:

- To estimate concentrations at receptors of interest using input emission rate data based on field measurements or emission model predictions.
- To design an air monitoring program (i.e., selecting monitoring locations and periods, chemicals of concern, and monitoring requirements) as well as to interprete monitoring results.

6.2.1 Emissions Inventory

As part of the site characterization, the initial portion of the air investigation requires the formation of a comprehensive air emissions inventory. The inventory will be derived from existing information sources and developed into a unified emissions inventory for FMC, Bannock Paving, and Simplot. The emissions inventory will be used for subsequent air studies and evaluating ARARs.

6.2.1.1 Review of Available Data

The initial portion of emissions inventory development will consist of a review of all available sources to categorize potential air emission sources by:

- Number and type of source, location, and variability of each source
- Physical parameters associated with each source (e.g., height, width, exit temperature, exit velocity, etc.) in sufficient detail to perform atmospheric dispersion modeling
- Emissions associated with each source and associated physical and chemical characteristics of the emissions. Emission rates will be developed for both short-term maximums and long-term average emission rates as appropriate.

Data sources used for this review include plant process information, available stack test data, existing air permit conditions, site inspection reports, and other miscellaneous FMC and Simplot data . There will also be extensive use of standard EPA emission factor reference documents (e.g., AP-42). Finally, emission data currently being prepared for the State of Idaho's Pocatello non-attainment area State

Implementation Plan (SIP) revision will be an essential data source for the particulate emissions.

This review will identify the extent and quality of information available for the air emission sources and data gaps. These data will be the primary input to the emissions inventory database.

6.2.1.2 *Emissions Inventory Database*

Following the review of existing data, a database of all emissions will be developed. This database will include all source information developed during the data review, as well as emission estimates from emission factors used to fill data gaps. Particulate data will include any available size distribution data and emission information from the revised State of Idaho PM_{10} emissions inventory, which will soon be available. The database will be limited to FMC and Simplot sources for the purposes of atmospheric dispersion modeling. While it is understood that there are additional sources offsite, the site characterization will initially focus on the FMC and Simplot sources only, with the exception of Bannock Paving, which although not connected to or associated with FMC, physically resides within FMC's property boundaries. For the remainder of Section 6.2, all references to FMC regarding emissions and air pathways analysis include Bannock Paving as a source. Additionally, as stated in Section 4.1.1, offsite slag will not be analyzed or included in the inventory. The database will address uncertainties associated with the input data and data gaps requiring further characterization.

Source data will be developed from current actual emission rates, permitted emissions, and as much as possible historical release rates. Historical rates are necessary to characterize potential deposition patterns that may have potentially contributed to adverse impacts over the years. Additionally, during the many years of plant operations, both facilities have substantially modified their processes from an air emissions standpoint.

One chemical, phosphorous pentoxide (P_2O_5), emitted by FMC poses a problem in the emission inventory. Initially, P_2O_5 is released as elemental phosphorus (P_4) in gaseous form from several points within the facility. P_4 oxidizes in the air very rapidly to P_2O_5 which is a particulate. However, P_2O_5 tends to hydrolyze due to moisture in the air and forms phosphoric acid. While this behavior is known, emission factors are presently unavailable to estimate these emissions. Additionally, because of this process, traditional EPA air monitoring methods for particulate matter fail to suitably sample for P_2O_5. Because of this, P_2O_5 will be initially treated as a PM_{10} emission in the air pathways atmospheric dispersion modeling analysis described in Section 6.2.3. However, P_2O_5 emissions will be clearly identified in the modeling analysis. An investigation of this issue will be conducted during the air pathways analysis to determine if better methods of estimating emissions, modeling, and/or monitoring relative to P_2O_5 exist.

6.2.2 Meteorological Data Review

For the purposes of air quality dispersion modeling, a set of the most representative and best available surface and upper air meteorological data is required. As described in Section 3.1.4, there are several data sets available. The initial phase of the air investigation will involve the review of these data sets to determine which is the most representative data set. Comparisons of surface data sets will be made between the NWS Pocatello airport data and the Simplot Site 1 data. Following the evaluation of the surface data and selection of the most representative site, appropriate surface meteorological data will be chosen for atmospheric dispersion analysis. The selected data set will be agreed upon by all concerned parties prior to the commencement of the atmospheric dispersion modeling analysis.

The atmospheric dispersion modeling analysis requires mixing height values derived from a representative upper air station. Currently, there are no mixing height data for Pocatello. While several upper air stations are available for use in the analysis, discussions with the EPA have indicated that data from the NWS station at Salt Lake City, Utah airport is the most representative station. Even though this station is about 150 miles south of Pocatello, sufficient similarities exist between the height of the station and complex terrain. Thus, these data will be used in this analysis.

Selection of the most suitable surface and upper air data set will consider the following factors to the extent possible:

- Monitoring site location and representativeness to the area
- Data recovery rate, quality assurance, and quality control procedures utilized
- Suitability of the data set to the air investigation.

The selected data set will be summarized into seasonal and annual wind roses, tabular summaries of means and extremes, and summaries of dispersion conditions. Since the local terrain is complex in nature (i.e., the terrain extends well above elevated points of release), day-night wind flow patterns will also be studied.

6.2.3 Atmospheric Dispersion Modeling Methodology

A discussion of the air dispersion modeling methodology, including the approach, selected models and air modeling investigation is presented below.

6.2.3.1 Approach

The diverse types and number of sources present at the FMC and Simplot facilities combined with locally elevated terrain and complex meteorological regimes require that a detailed modeling approach be utilized to determine air quality impact. Additionally, since potential contaminants can be released from both ground level sources and elevated sources, impacts will be predicted for the following scenarios:

- Simple terrain, which is defined as receptors below the height of elevated release
- Intermediate terrain, which is defined as receptors between the height of elevated release (generally the stack height) and the plume centerline
- Complex terrain, which is defined as receptors greater than or equal to the plume centerline
- Wind blown fugitive dust, which accounts for one means of removal of particulate material from the site being deposited on the nearby terrain

- Air stagnation conditions, which are characterized by calm or very low wind speeds and variable wind directions. These stagnant meteorological conditions may persist for several hours to several days. During stagnation conditions, the dispersion of air pollutants, especially those from low-level emissions sources, tends to be minimized, potentially leading to relatively high ground level concentrations. This effect is of concern during the wintertime in the Pocatello area.

The above scenarios require the use of four atmospheric dispersion models. Model predictions will be produced for maximum hourly, seasonal and annual concentrations depending on the pollutant being analyzed. These concentration and/or deposition values will be produced for both sources of particulate matter and gaseous emission sources based on the results of the emission inventory described in Section 6.2.1 by all models as appropriate. As a check of model performance, presently available air monitoring results will be used to compare model predictions. Models will be tested versus their EPA approved benchmark runs prior to use for verification purposes.

6.2.3.2 *Model Selection*

Interpretive dispersion models prepared for use in the air investigation are described in this section.

Simple Terrain Model. The Industrial Source Complex - Short Term 2 (ISCST2 Version 92062) atmospheric dispersion model will be used to predict short-term air contaminant levels on simple terrain from the operation of the sources. This model is the recommended model for RI/FS investigations due to its ability to simulate a large number of source types and meteorological conditions (EPA, 1989b). The features of this EPA approved steady-state Gaussian dispersion model make it uniquely qualified to meet the demands of this simple terrain analysis. These features are highlighted below:

- Concentration averaging times ranging from 1 hour to 1 year
- Physical separation of multiple sources
- Directional dependent atmospheric downwash

- A variation of wind speed with height following the wind-profile exponent law
- Plume rise due to buoyancy and/or momentum as a function of distance
- Difference in terrain elevation of receptors
- Multiple, noncollocated, point, area, line and volume sources with variable emission rates
- Gravitational settling and dry deposition of particulates
- Use of representative hourly average meteorological data.

Fugitive Dust Model. The EPA guidance recommends the EPA's Point, Area, Line Dust Source model be used to evaluate fugitive dust (EPA, 1989b). Subsequent to this guidance, the EPA's Fugitive Dust Model (FDM version 91109) was released. FDM is specifically designed for computing concentration and deposition impacts from fugitive dust sources. The sources may be point, line or area sources. The model has not been designed to compute the impacts of buoyant point sources, thus it contains no plume-rise algorithm. The model is generally based on the well-known Gaussian Plume formulation for computing concentrations, but the model has been specifically adapted to incorporate an improved gradient-transfer deposition algorithm. Emissions for each source are apportioned by the user into a series of particle size classes. Gravitational settling and deposition velocities are calculated by FDM for each stability class. Concentration and deposition are computed at all user-selectable receptor locations.

The model is designed to work with pre-processed meteorological data or with card-images of meteorological data in either hourly or Stability Array (STAR) format. FDM accepts hourly meteorological data output from the EPA RAMMET meteorological pre-processor program and provide output for 1-, 3-, 8-, and 24-hour averages and a long-term average which is the average over the entire meteorological database.

Elevated Terrain Model. To evaluate air contaminant concentrations in elevated terrain from point sources, the COMPLEX-I (version 90095) dispersion model will be used. This model is the recommended model for rural elevated terrain impacts (EPA, 1986). The main features of this model are listed below:

- Concentration averaging times ranging from 1 hour to 1 year
- Physical separation of multiple sources
- A variation of wind speed with height following wind-profile exponent law
- Multiple point sources with terrain adjustment
- Horizontal spreading uniform across a 22.5-degree sector
- Uses representative sequential hourly average meteorological data.

COMPLEX-I has the ability to predict concentrations only from point sources. This fact limits the models effectiveness in elevated terrain for the varied type of sources found at the FMC and Simplot facilities. However, since the significant elevated impacts are expected to be produced only by point sources, this model limitation should not impair the air investigation results.

Air Stagnation Model. To account for particulate material deposited and other modeled pollutants during air stagnation conditions in Pocatello, the EPA recommended WYNDvalley, will be utilized (EPA, 1990r). The WYNDvalley (version 3.0) model is a multilayer Eulerian grid dispersion model that permits users flexibility in defining borders around the areas to be modeled, the boundary conditions at these borders, the intensities and locations of emissions sources, and the winds and diffusivities that affect the dispersion of atmospheric pollutants. The model's output includes gridded contour plots of pollutant concentrations for the highest brief episodes (during any single period), the highest and second-highest 24-hour averages, averaged dry and wet deposition fluxes, and temporal plots of the concentrations at specified receptor sites and statistical inference of the probabilities that standards will be exceeded at those sites.

6.2.3.3 *Model Options*

Atmospheric dispersion models such as ISC, FDM, COMPLEX-I, and WYNDvalley contain many user specified options which allow the user to control the models simulation features. The EPA has provided a list of so called "regulatory default" options (EPA, 1986, 1989b). These require the user to employ only certain model features for regulatory analysis applications. For the air pathways analysis, EPA regulatory default options will be followed. Recent EPA guidance will be factored into the analysis. Some of the more important model optional features are described in the following sections.

Annual Concentrations and STAR Data. As discussed in Section 6.2.3.2, FDM and a long term version of the ISC2 (ISCLT2) model have the ability to accept as input annual joint frequencies of wind speed and direction versus stability class data (referred to as STAR data). These data are used by these models to calculate annual values of concentration or deposition at specified receptors. Discussions with the EPA have indicated that due to the presence of complex terrain and the necessity to analyze for intermediate terrain, the input meteorological data should be the same for all models. Thus, by prior agreement with the EPA, no STAR data will be used in this study. This means that no analysis will be conducted with ISCLT2. Annual concentration and/or deposition values calculated from ISC2, FDM, and COMPLEX-I will be derived from hourly meteorology averaged over an annual period. This is a normal function for all three models.

Terrain Handling. As discussed in Section 6.2.3.1, the air pathways analysis will require complex terrain modeling. Both ISC2 and COMPLEX-I modeling will require terrain input. Resolution of results predicted by the two models will be achieved in the following manner.

For receptors below the release height of a source, the results from ISC2 will be utilized. For receptors above the final plume height, COMPLEX-I results will be used. Receptors between the release height and the final rise of the plume will be analyzed for the higher of the two modeled concentration predictions. This approach, which will require a post-processing program or other EPA acceptable technique to analyze model output, is consistent with recent EPA modeling guidance on intermediate terrain modeling (EPA, 1990).

Receptor Grids. For the air pathways analysis, multiple sets of receptor grids will be used. Beyond 2 km mixed sets of polar and rectangularly spaced course grids, based on a pseudo-logarithmic increasing progression in separation distance, is proposed. In close proximity to the site, within 2 km, mixed sets of polar and rectangularly spaced fine grids of receptors will be employed to adequately cover local impacts on the surrounding terrain. Additionally, the air pathways analysis will include receptors at sensitive population locations such as hospitals and schools.

Course Grid. The coarse receptor grid proposed for use in the air pathways analysis will begin 2 km from the site. Receptors will be placed at 500-meter intervals until 5 km where the spacing will change to 1 km intervals. At 10 km, spacing will change again to 2500-meter intervals until 20 km where the spacing will increase to 5 km out to 50 km in distance. This placement of receptors will be modified if either an area of elevated concentrations (termed a "hot spot") is identified or if predicted concentrations diminish to near zero values.

Fine Grid. To better represent localized impacts from FMC and Simplot emissions, a fine receptor grid will be used close to the site. This grid will extend inward from 2 km at 100-meter intervals from the site. If localized hot spots are identified, additional receptors will be placed at closer intervals to isolate the hot spot location. An additional array of receptors will be placed at approximately 100-meter intervals along the site boundary to symbolically represent the first point of public exposure. Receptors will also be placed within the FMC and Simplot boundary to estimate worker exposure and at existing locations of ambient air monitoring stations for later comparison with monitoring data.

Display of Modeled Data. Model-predicted ground level concentration and deposition values will be tabulated for maximum hourly, daily, and long-term values at sensitive receptors. Daytime and nighttime averages and maximums and impacts on elevated terrain will also be calculated. Extensive use of computer-produced isopleths of spatial distributions of concentration and deposition values will be also be prepared.

6.2.3.4 *Dispersion Modeling Investigations*

Atmospheric dispersion modeling will be used to investigate several different aspects of the air pathways analysis. These investigations are highlighted in the following sections.

Soil Sampling. The first investigation of primary importance to the air pathways analysis will be the estimation of local particulate deposition values. Particulate emission data, both current and historical, will be used to graphically predict annual deposition patterns. These patterns will be compared with field measurements of soil concentrations described in Section 6.3.

Correlation of Modeling with Existing Monitoring Data. To better understand local atmospheric dispersion model predictions and to approximate dispersion model performance, data from the local ambient air quality monitoring network will be used to correlate historically observed concentrations with modeled predictions of SO_2 and PM_{10}. These two contaminants are the only available sources of data that can serve as tracers for modeled concentrations. Evaluations will be done for both the maximum predicted concentrations and temporal and spatial distributions of concentrations. Given that the traditionally stated accuracy of Gaussian dispersion models is within a factor of two of observed values, agreement between a model and observed values will be required to be at least within this factor to show minimum correlation. If at the conclusion of this analysis model performance remains unclear, data taken during the future air monitoring program (Section 6.2.4) could be used to further investigate model performance.

Identification of Air Monitoring Sites. Another important air pathways analysis investigation will be the identification of required air monitoring sites. Since this study will consider both FMC and Simplot as combined sources, an assessment can be made as to the adequacy of the placement of existing air monitoring network. Based on correlations with historical monitoring values and predicted contaminant concentration levels, model predictions will be used to evaluate the placement of the current monitoring sites and identification of other site areas. The relationship between the atmospheric dispersion modeling analysis and the air monitoring investigation is described in detail in Section 6.2.4.

Evaluation of Modeling Input Data and Identification of Future Data Needs. Model predictions in comparison with historical monitored concentrations will be used to evaluate the emission database for adequacy. Since a major portion of model uncertainty is usually the estimated emission parameters, a sensitivity analysis will be conducted to identify sources that may require better characterization. Based on this evaluation, additional literature search or field studies may be required to better characterize these sources. Additionally, the meteorological input data will be evaluated to determine if, for example, the choice of the upper air data station is adequate versus measurements taken on site.

6.2.4 Future Air Monitoring Program

The existing Pocatello air monitoring network was installed to meet the specific needs of the National Ambient Air Quality Standards under the Federal Clean Air Act and State of Idaho Air Quality Rules. Based on a review of the current system and discussions with the EPA, it is clear that additional monitoring will be required to satisfy air monitoring requirements under CERCLA. Consequently, FMC and Simplot commit to conduct an expanded ambient air monitoring program under this RI/FS. However, data existing at this time are inadequate to determine what additional monitoring will be required. Therefore, a separate air pathways Monitoring Plan will be developed once monitoring needs have been identified. To properly plan and implement the air pathways monitoring program, the results of the atmospheric dispersion modeling air pathways analysis, described in Section 6.2, will be used as the primary tool. This modeling analysis will:

- Identify the potential air pathways chemicals of concern.
- Evaluate the existing monitoring network data by comparing monitored data to modeled predictions.
- Identify additional monitoring site areas and/or parameters in lieu of, or in addition to, the existing monitoring network.

At the conclusion of the air pathways modeling analysis, an air pathways Monitoring Plan will be prepared. The Monitoring Plan will be specific to air pathways and will not be incorporated into the existing EMF Sampling and Analysis Plan (i.e., the ambient air monitoring program description will be a stand-alone document). The Monitoring Plan will be based on current EPA guidance for CERCLA sites (EPA, 1989b) and will contain the following items:

- Identification of the Chemicals of Concern and Proposed Monitoring Methods. The primary item of concern in the Monitoring Plan will be the identification of the chemicals of concern for which monitoring or additional monitoring is required, and proposed monitoring methods. Based on the air pathways analysis modeling of known emissions, requirements for data on additional contaminants not presently monitored will be identified. Additionally, revised or expanded methods for sampling and analysis of existing contaminants may be required. These needs will be specified in the Monitoring Plan. Data quality objectives for the monitoring program will also be addressed.
- Identification of Potential Monitoring Sites. The second item addressed by the Monitoring Plan will be the identification of potential monitoring sites. The results of the air pathways modeling analysis will provide the basic areal and spatial definition of potential site areas. These data will be used to localize potential monitoring sites within these areas. Localization of air pathways monitoring sites may require a compromise between the need to collect data at a specific point (from a modeling analysis standpoint) and the ability to physically site and operate instruments at that point. Needs such as site access, electric power requirements, site security, and land acquisition often outweigh other siting factors. Thus, while the Monitoring Plan will be as specific as possible about site localization, some readjustment of site locations may be required prior to monitoring.
- Schedule for Implementation of Ambient Air Monitoring. The final item addressed in the Monitoring Plan will be the schedule for implementation of ambient air monitoring, including site preparation, equipment installation, station operation, and the expected duration of the program. Monitoring for some chemicals may require a period of at least one year to account for seasonal meteorological influences. However, more or less time may be required for other chemicals to obtain representative samples. These specifics will be detailed in the Monitoring Plan.

Upon approval of the air pathways Monitoring Plan, a Sampling and Analysis Plan will be developed specific to the agreed upon monitoring program. The Sampling and Analysis Plan will contain the Quality Assurance Program Plan for the air pathways monitoring program. Air monitoring will begin following acceptance of the Sampling and Analysis Plan.

6.2.5 Data Analysis

Upon completion of the air monitoring, air monitoring results will be compared with air modeling predictions. If major discrepancies exist, an evaluation will be made to identify the reason(s) for the discrepancies. If merited by the nature and/or magnitude of the discrepancies, additional air modeling and/or air monitoring will be performed. The results of both air modeling and air monitoring will be used to assess risks associated with the air pathway and to identify and evaluate appropriate source controls.

6.3 OFFSITE SURFACE SOIL INVESTIGATION

This investigation is being done as part of the air pathway evaluation. The offsite soil sampling program will provide data which will be used in the risk assessment.

The offsite surface soil investigation will collect surface soil samples to:

- Establish current levels of chemicals and radionuclides over a broad area for the soil associations (described in Section 3.1.5) in the vicinity of the FMC and Simplot facilities.
- Identify trends, if any, in surface soil concentrations related to soil associations and distance from the FMC and Simplot facilities.
- Assess the degree to which air emissions from the FMC and Simplot facilities may have impacted soils in the area.

The characterization of offsite surface soils will be accomplished through a phased sampling program.

6.3.1 Rationale for Establishing Current Levels of Chemicals and Radionuclides

Samples will be collected to accomplish the objectives stated above. Selection of specific surface soil sample locations and numbers will be based on establishing current levels of chemicals for each major soil association in the EMF site vicinity to a distance sufficient to evaluate the impact that aerial deposition of particulates from the FMC and Simplot facilities may have had on these soils.

Soil surveys conducted in the Fort Hall and Bannock County area show generally good agreement between chemical and physical characteristics for major soil types identified, although different soil association names have been applied in the two areas (see Section 3.1.5). For the purposes of this soil sampling program, soil associations with similar characteristics were considered as one soil association. (See Table 3-4.)

Because levels of naturally occurring metals and radionuclides may differ from one soil association to another, sufficient numbers of sample locations will be selected to be representative of each major soil association and, to the extent possible, will be collected in areas which are least likely to have been disturbed by agriculture or other land uses. Collection of undisturbed samples may be difficult in some areas due to current land use practices. Individual surface soil samples will be collected at the surface (0 to 2 inches), and at a depth of approximately 2 feet below the surface, to allow comparison of the effect of depth on the concentrations of chemicals in the soil and to provide additional data on the characteristics of undisturbed soils.

6.3.2 Phase I Scope of Work

The Phase I surface soil sampling program is designed to:

- Sample all major soil associations within a 3-mile radius of the facilities at the surface (0 to 2 inches) and at a depth of 2 feet.
- Provide data about the areal distribution of chemicals within the vicinity of the facilities.

6.3.2.1 *Rationale*

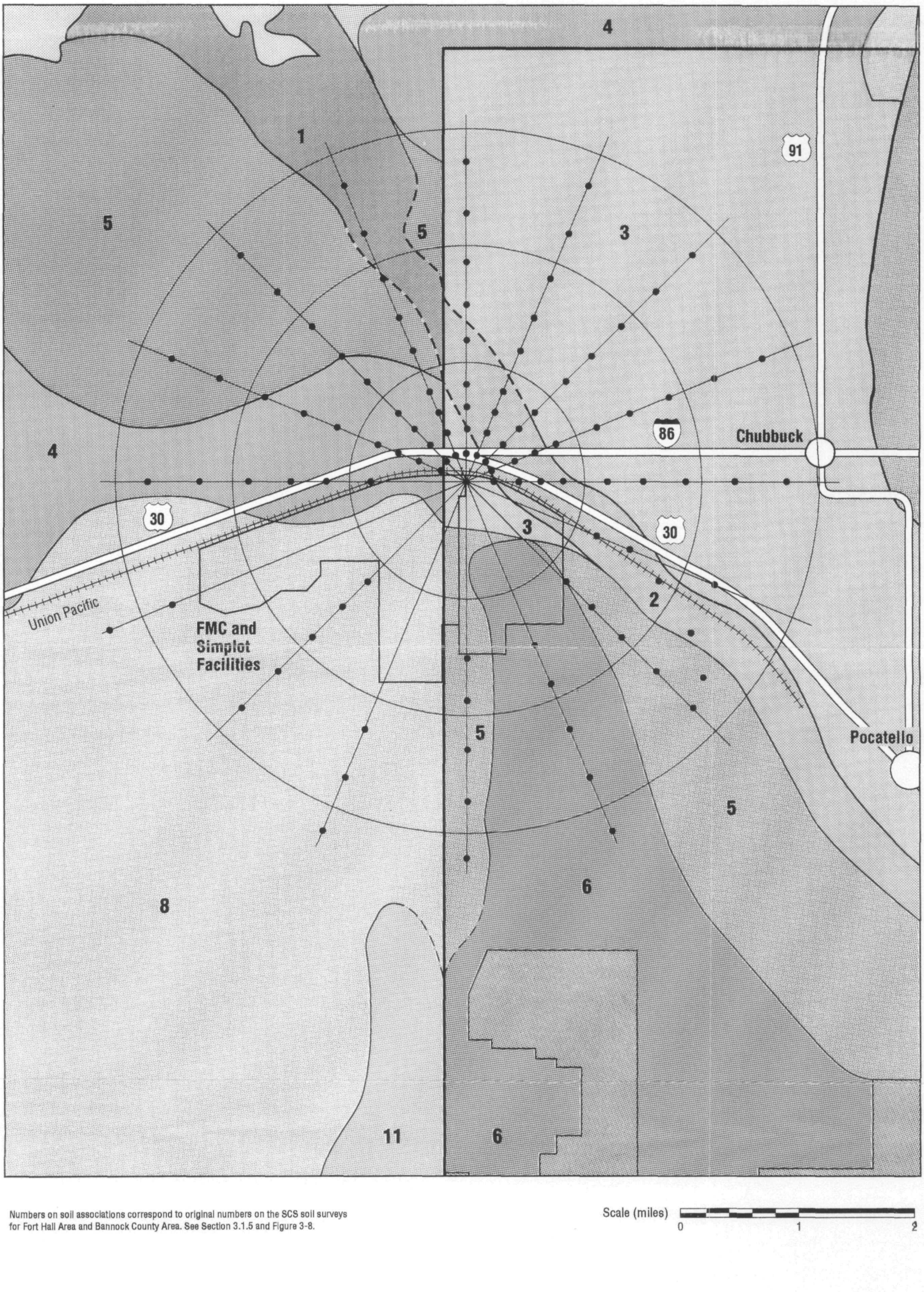
Each soil association will be sampled at several locations along one or more transects of the association. (See Figure 6-5.) Sample locations will be selected to reflect, to the extent possible, undisturbed conditions. "Undisturbed" refers to the absence of chemical or physical influences from agriculture or other human activities. "Impacted" describes soils which may have been subjected to aerial deposition. In many locations, undisturbed conditions for surface sampling locations may be unachievable. At these locations, field observations combined with the historical land use and disturbance of soils will be used in interpreting results of the sample analyses.

At each sampling location along the transect, four surface (0 to 2 inches) soil samples will be collected within a 100-foot radius of the center of the sampling location. Sampling points will be selected at random from undisturbed areas (or least disturbed areas) within the sample location. These four samples will be composited in the field and analyzed for the parameters shown in Table 6-9. Radiological analyses will be performed on samples from every other sample location along each of the sample transects. Where possible, one sample will also be collected at a depth of approximately 2 feet at one of the of the four surface sample points selected at random. All soil samples will be passed through a number 4 sieve (approximately the size of fine sand) to remove larger soil particles which are less likely to have been transported by wind. The finer fraction will be sent to the laboratory for analysis.

Compositing will smooth variations in the surface soils due to disturbances and will produce more representative results. Since the 2-foot sampling depth is below the depth of most disturbance or impact, compositing is not necessary for these samples.

6.3.2.2 *Surface Soil Sampling Locations*

Sixteen equally spaced transects have been extended from a center point located on the boundary between the FMC and Simplot facilities (see Figure 6-5). This center



Numbers on soil associations correspond to original numbers on the SCS soil surveys for Fort Hall Area and Bannock County Area. See Section 3.1.5 and Figure 3-8.

Figure 6-5 Offsite Soil Sampling Locations with Soil Types in EMF Site Vicinity

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Table 6-9
ANALYTICAL PARAMETERS
OFFSITE SURFACE SOIL SAMPLES

I. Heavy Metals	II. General Mineral
Aluminum	Fluoride
Antimony	Phosphorus (total)
Arsenic	Phosphorus (orthophosphate)
Barium	
Beryllium	**III. Radioactivity[(a)]**
Boron	Gamma spectrometry[(b)]
Cadmium	Uranium-238
Chromium	Polonium-210
Cobalt	
Copper	**IV. Other**
Iron	pH
Lead	
Lithium	
Manganese	
Mercury	
Molybdenum	
Nickel	
Selenium	
Silver	
Thallium	
Vanadium	
Zinc	

(a) Radiological analyses will be performed on samples from every other sample location along each of the 16 transects.

(b) Includes identification of lead-210.

point was selected to be approximately equidistant between the major air emission sources of the two facilities.

Sample locations were then selected along the transects in a pattern based upon a regularly increasing spacing of sampling points with distance from the center point. Four sample locations were located at regular intervals within the first mile, three locations within the second mile, and two locations within the third mile. This distribution pattern was based upon previous studies (USGS, 1977; J.R. Simplot, 1990) in the vicinity which indicated that the highest levels of metals and fluoride were found in soils and vegetation within one mile of the facilities.

A systematic grid sampling program would have produced a number of sample locations within the operating plant boundaries. Since this surface soil sampling investigation is designed to target undisturbed soils, surface soil sample locations falling within the facility boundaries have been deleted. The potential source investigation (Section 6.1) addresses surface soil sampling within the FMC and Simplot facility boundaries. The remaining sample locations were then refined and augmented based on the following considerations:

- Soil type
- Topography
- Land use

Soil Type. Figure 6-5 shows the surface soil sampling locations in relation to the soil types within the sampling area. With the proposed sample location distribution, there are a minimum of six sampling locations for the Camelback-Hades-Valmar association. This soil association occupies a relatively small part of the total sampling area. Overall, there is an average of more than 17 sampling locations per soil association, with the range from 6 to 27. A total of 106 sampling locations are proposed.

Topography. The region to the southeast of the FMC and Simplot facilities contains topographic high points which may be areas particularly susceptible to aerial deposition due to the local meteorological conditions. Sampling locations in this area were adjusted to include locations on the topographic highs. Figure 6-6 shows the surface soil sampling locations in relation to the topography of the sampling area.

Land Use. It is difficult to obtain undisturbed samples in a highly residential area. The southeastern portion of the sampling region extends into the City of Pocatello. These areas have been identified from available maps and the sample locations have been adjusted accordingly.

6.3.3 Soil Sample Analysis

All soil samples collected will be analyzed for heavy metals, fluoride, total phosphorus, gross beta, and radium 226. A list of specific surface soil analyses is provided in Table 6-9.

6.3.3.1 Identification of Specific Sampling Points (Field Check Activity)

Sample locations shown in Figures 6-5 and 6-6 are approximate. A field verification will be conducted prior to the actual soil sampling to visually inspect each sampling location and select specific sampling points within the sampling location. Variations from the plan will be documented in field notes and explained in subsequent site characterization reports. Aerial photographs will be used to refine the locations as much as possible before the actual sampling field work begins, but field observations of specific areas will also be made and the best technical judgment of the sampling team will determine final locations.

6.3.3.2 Data Analysis

Data collected during Phase I of the surface soil investigation will be thoroughly analyzed to ensure that data quality objectives for laboratory analysis have been attained. Data analysis will include:

- Mapping the spatial distribution of the data and preparing plots which show the relationship of soil concentrations of metals and radionuclides as a function of distance from the site. Both the surface composite samples and those from the 2-foot depth will be evaluated for spatial distribution trends which can be correlated with impacts from the site.

- Comparing the relationship between surface soil composites and samples from the 2-foot depth interval and evaluating differences, with particular emphasis on differences in concentration of chemicals and radionuclides due to disturbance of the surface layers (e.g., from agricultural activity or due to aerial deposition).
- Comparing concentrations of chemicals and radionuclides in undisturbed soil samples between soils of different soil associations to evaluate any differences due to soil type.

6.3.4 Phase II Scope of Work

Additional of surface soil sampling may be needed to further refine the data collected in Phase I. The need for additional sampling will be evaluated by FMC, Simplot, and the EPA after a thorough analysis of Phase I data and a complete review of final air modeling results. The criteria that will be used in the evaluation are:

- Adequate sample location coverage for each soil association
- Adequate sample location coverage for evaluation of the aerial deposition patterns of chemicals within the vicinity of the facilities.
- Adequate data for EPA assessment of risk

6.4 GEOLOGIC AND SUBSURFACE SOILS INVESTIGATION

A Phase I geologic and subsurface soils investigation will be conducted to further characterize the hydrogeologic condition beneath the EMF site. The field program will consist of borehole drilling for installation of groundwater wells, collection of subsurface soil samples, and preparation of geologic logs. The locations of proposed geologic borings/wells are shown in Figure 6-7. Boring/well locations are approximate and may be adjusted in the field to minimize obstruction of plant operations and/or to prevent contact with utilities (e.g., power lines, water and gas mains). The rationale for each proposed boring and well is summarized on Table 6-10.

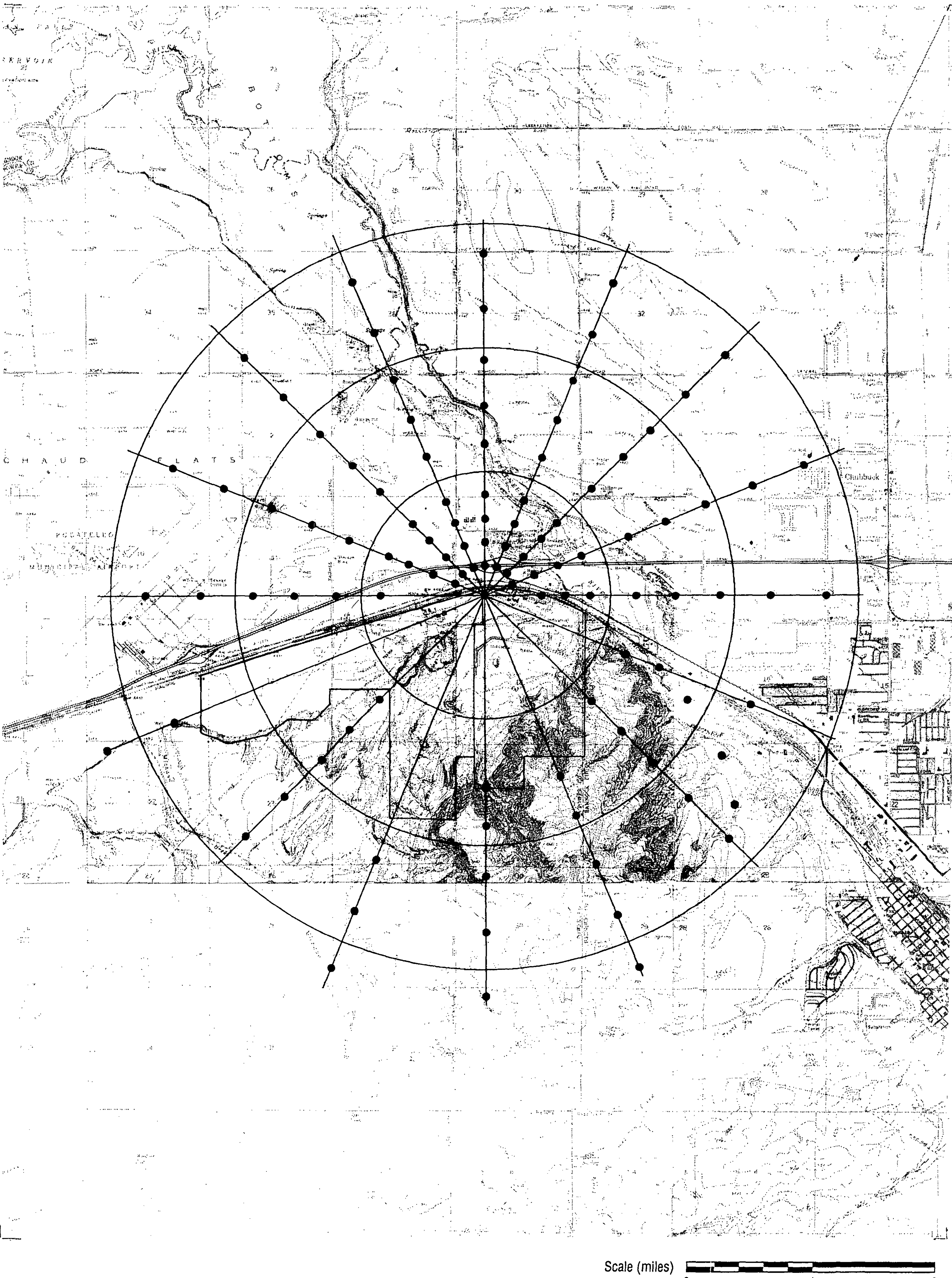

Figure 6-6 Offsite Soil Sampling Locations with Regional Topography

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Proposed Well Locations

Table 6-10
LOCATION AND OBJECTIVES FOR PROPOSED BORINGS AND WELLS

Boring/ Well and Location		Geologic and Soils Investigation Objectives	Groundwater Investigation Objectives
FMC Facility			
139	Bannock Paving, south central location	Geologic boring to be drilled to bedrock to define lithology and depth to bedrock.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient, to define groundwater quality, and to further delineate the arsenic plume in western portion of the FMC facility.
140	Bannock Paving, northeastern location	Geologic boring to be drilled to bedrock to define lithology and depth to bedrock.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient, to define groundwater quality, and to further delineate the arsenic plume in western portion of the FMC facility.
141	Central old ponds location, between old ponds 3S and 10S	Geologic boring to be drilled to bedrock to define lithology and depth to bedrock.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient, to define groundwater quality, and to further delineate the arsenic plume in western portion of the FMC facility.
142	South of calciner ponds	Geologic boring to be drilled to bedrock to define lithology and depth to bedrock.	Install well in the first water-bearing interval (possible bedrock) to establish a groundwater elevation and hydraulic gradient, and to define groundwater quality upgradient of the calciner ponds.
143	Between calciner ponds and main plant facilities, north of slag pile	Geologic boring to be drilled to bedrock to define lithology and depth to bedrock.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient, to define groundwater quality, and to delineate plumes in the eastern portion of the FMC facility.
144 & 145 (well pair)	Eastern FMC facility, near well FMC-2	Geologic boring 144 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 144 into bedrock to establish a hydraulic gradient and to define groundwater quality. Install well 145 in a deep, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality.
146	Northeastern FMC facility boundary, near Highway 30	Geologic boring to be drilled to first water-bearing interval to define lithology.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient, to define groundwater quality, and to delineate plumes in northeastern portion of the FMC facility.

Table 6-10 (Cont'd)

Boring/ Well and Location		Geologic and Soils Investigation Objectives	Groundwater Investigation Objectives
FMC Facility (Cont'd)			
147	North of proposed RCRA Pond 16S	Geologic boring to be drilled to first water-bearing interval to define lithology.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality.
148	West of proposed RCRA Pond 16S	Geologic boring to be drilled to first water-bearing interval to define lithology.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality.
149	South of proposed RCRA Pond 16S	Geologic boring to be drilled to first water-bearing interval to define lithology.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality.
150	North of Pond 8S	Geologic boring to be drilled to first water-bearing interval to define lithology.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality downgradient of Pond 8S.
151	Northeast of Pond 8S	Geologic boring to be drilled to first water-bearing interval to define lithology.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality downgradient of Pond 8S.
152	Northeast of Pond 8S	Geologic boring to be drilled to first water-bearing interval to define lithology.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality downgradient of Pond 8S.
153	West of proposed RCRA Pond 16S	Geologic boring to be drilled to first water-bearing interval to define lithology.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality downgradient of Pond 8S.

Table 6-10 (Cont'd)

Boring/ Well and Location		Geologic and Soils Investigation Objectives	Groundwater Investigation Objectives
Simplot Facility			
300	Adjacent to PEI-3	Geologic boring to be drilled into bedrock to define lithology and depth to bedrock.	Install well in the deep, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality downgradient of the gypsum stack. Comparison of chemical data for samples from well 300 and PEI -3 should confirm wether PEI-3 monitors a saturated zone above the suspected water table, an issue described in Section 3.3.3.
301	Southwest of well PEI-1	Geologic boring to be drilled into bedrock to define lithology and depth to bedrock.	Install well in the deep water-bearing interval (fractured/weathered bedrock) to establish a hydraulic gradient and to define groundwater quality upgradient of the gypsum stack. Well 301 will replace well PEI-1 (due to future expansion of gypsum stack).
302	South of well PEI-5	Geologic boring to be drilled into bedrock to define lithology and depth to bedrock.	Install well in the deep water-bearing interval (fractured/weathered bedrock) to establish a hydraulic gradient and to define groundwater quality upgradient of the gypsum stack. Well 302 will replace well PEI-5 (due to future expansion of gypsum stack).
303	South of gypsum stack; equidistant from wells PEI-1 and PEI-5	Geologic boring to be drilled into bedrock to define lithology and depth to bedrock.	Install well in the deep water-bearing interval (fractured/weathered bedrock) to establish a hydraulic gradient and to define groundwater quality upgradient of the gypsum stack.
304	Along west side of gypsum stack, adjacent to FMC-Simplot property line	Geologic boring to be drilled into bedrock to define lithology and depth to bedrock.	Install well in the deep water-bearing interval (fractured/weathered bedrock) to establish a hydraulic gradient and to define groundwater quality upgradient of the Simplot facility and downgradient of the gypsum stack.
305	Adjacent to northeast corner of gypsum stack	Geologic boring to be drilled into bedrock to define lithology and depth to bedrock.	Install well in the deep, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality adjacent to the gypsum stack. Well 305 to further define extent of arsenic detected at well PEI-3.

Table 6-10 (Cont'd)

Boring/ Well and Location		Geologic and Soils Investigation Objectives	Groundwater Investigation Objectives
Simplot Facility (Cont'd)			
306	North of gypsum stack, adjacent to well PEI-2	Geologic boring to be drilled into bedrock to define lithology and depth to bedrock.	Install well in the deep, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality downgradient of the gypsum stack. Well 306 will replace well PEI-2 (damaged).
307	Northwest of gypsum stack, adjacent to FMC-Simplot property line	Geologic boring to be drilled into bedrock to define lithology and depth to bedrock.	Install well in the deep, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality upgradient of the Simplot facility and downgradient of the gypsum stack.
308	Adjacent to the FMC calciner ponds, east to the FMC-Simplot property line on Simplot property	Geologic boring to be drilled into bedrock to define lithology and depth to bedrock.	Install well in the deep, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality.
309 & 310 (well pair)	Southwest of Simplot facility adjacent to FMC-Simplot property line	Geologic boring 309 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 309 in the deep, unconsolidated water-bearing interval to establish vertical and horizontal hydraulic gradients and to define groundwater quality. Install well 310 in the shallow, unconsolidated water-bearing interval to establish hydraulic gradients and to further define extent of contaminants detected in nearby wells.
311 & 312 (well pair)	West end of Simplot facility	Geologic boring 311 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 311 in the deep, unconsolidated water-bearing interval to establish vertical and horizontal hydraulic gradients and to define groundwater quality. Install well 312 in the shallow, unconsolidated water-bearing interval to establish hydraulic gradients and to further define extent of contaminants detected in nearby wells. To determine aquifer characteristics of the shallow, unconsolidated water-bearing interval (proposed pumping test location).

Table 6-10 (Cont'd)

Boring/ Well and Location		Geologic and Soils Investigation Objectives	Groundwater Investigation Objectives
Simplot Facility (Cont'd)			
313 & 314 (well pair)	South of Simplot facility	Geologic boring 313 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 313 in the deep, unconsolidated water-bearing interval to establish vertical and horizontal hydraulic gradients and to define groundwater quality. Install well 314 in the shallow, unconsolidated water-bearing interval to establish hydraulic gradients and to define groundwater quality.
315 & 316 (well pair)	Along northwestern edge of the former gypsum stack and downgradient of the gypsum decant pond	Geologic boring 315 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 315 in the deep, unconsolidated water-bearing interval to establish vertical and horizontal hydraulic gradients and to define groundwater quality adjacent to the northernmost gypsum stack. Install well 316 in the shallow, unconsolidated water-bearing interval to establish hydraulic gradients and to define groundwater quality adjacent to the northernmost gypsum stack.
317 & 318 (well pair)	Adjacent to north corner of the former gypsum stack, downgradient of the east overflow pond	Geologic boring 317 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 317 in the deep, unconsolidated water-bearing interval to establish vertical and horizontal hydraulic gradients and to define groundwater quality downgradient of the east overflow pond and northernmost gypsum stack. Install well 318 in the shallow, unconsolidated water-bearing interval to establish hydraulic gradients and to define groundwater quality downgradient of the east overflow pond and northernmost gypsum stack.
319 & 320 (well pair)	North of Simplot facility and railroad tracks	Geologic boring 319 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 319 in the deep, unconsolidated water-bearing interval to establish vertical and horizontal hydraulic gradients and to define groundwater quality. Install well 320 in shallow, unconsolidated water-bearing interval to establish hydraulic gradients and to further define extent of contaminants detected in nearby wells.

Table 6-10 (Cont'd)

Boring/ Well and Location		Geologic and Soils Investigation Objectives	Groundwater Investigation Objectives
Simplot Facility (Cont'd)			
321	Northeast of northern edge of the former gypsum stack, adjacent to well PEI-4	Geologic boring 321 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 321 in the deep, unconsolidated water-bearing interval to establish vertical and horizontal hydraulic gradients and to define groundwater quality downgradient of the former gypsum stack. To determine aquifer characteristics of the deep, unconsolidated water-bearing interval (proposed pumping test location).
North and East of FMC and Simplot Facilities			
500 & 501	North of FMC's northern boundary, between Interstate 86 and Highway 30	Geologic boring 500 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 500 in the deep unconsolidated water-bearing interval to establish vertical and horizontal gradients and to define groundwater quality. Install well 501 in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradients and to define groundwater quality. Wells 500 & 501 will aid in delineation of the northern boundary of the EMF Site.
502	North of the FMC-Simplot property line, near Interstate 86	Geologic boring to be drilled to bedrock to define lithology and depth to bedrock.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality. Well 502 will aid delineation of the northern boundary of the EMF Site.
503	North of Simplot facility and west of the Portneuf River.	Geologic boring to be drilled to bedrock to define lithology and depth to bedrock.	Install well in the shallow, unconsolidated water-bearing interval to establish a hydraulic gradient and to define groundwater quality. Well 503 will aid delineation of the northern boundary of the EMF Site.

Table 6-10 (Cont'd)

Boring/ Well and Location		Geologic and Soils Investigation Objectives	Groundwater Investigation Objectives
North and East of FMC and Simplot Facilities (Cont'd)			
504 & 505	Northeast of the Simplot water treatment ponds	Geologic boring 504 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 504 in the deep, unconsolidated water-bearing interval to establish vertical and horizontal hydraulic gradients and to define groundwater quality downgradient of the water treatment ponds and adjacent to the Portneuf River. Install well 505 in the shallow, unconsolidated water-bearing interval to establish hydraulic gradients and to define groundwater quality downgradient of the water treatment ponds and adjacent to the Portneuf River.
506 & 507 (well pair)	Between the Portneuf River, Highway 30, and northeast of wells PEI-4 and PEI-6	Geologic boring 506 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 506 in a deep, unconsolidated water-bearing interval to establish vertical and horizontal hydraulic gradients and to define groundwater quality downgradient of the former Gypsum Stack and adjacent to the Portneuf River. Install well 507 in shallow, unconsolidated water-bearing interval to establish hydraulic gradients and define groundwater quality downgradient of the former Gypsum Stack and adjacent to the Portneuf River. Define relationship of the Portneuf River to the hydrogeologic units to the east and west.
508 & 509 (well pair)	East side of Portneuf River	Geologic boring 508 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 508 in a deep, unconsolidated water-bearing interval to establish groundwater elevation and hydraulic gradients east of the Portneuf River. Install well 509 in shallow, unconsolidated water-bearing interval to establish groundwater elevation and hydraulic gradients east of the Portneuf River. Define relationship of the Portneuf River to the hydrogeologic units to the east and west.

Table 6-10 (Cont'd)

Boring/ Well and Location		Geologic and Soils Investigation Objectives	Groundwater Investigation Objectives
North and East of FMC and Simplot Facilities (Cont'd)			
510 & 511 (well pair)	East side of Portneuf River	Geologic boring 510 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 510 in a deep, unconsolidated water-bearing interval to establish groundwater elevation and hydraulic gradients east of the Portneuf River. Install well 511 in shallow, unconsolidated water-bearing interval to establish groundwater elevation and hydraulic gradients east of the Portneuf River. Define relationship of the Portneuf River to the hydrogeologic units to the east and west.
512 & 513 (well pair)	East side of Portneuf River	Geologic boring 512 to be drilled to bedrock to define lithology and depth to bedrock.	Install well 512 in a deep, unconsolidated water-bearing interval to establish groundwater elevation and hydraulic gradients east of the Portneuf River. Install well 513 in shallow, unconsolidated water-bearing interval to establish groundwater elevation and hydraulic gradients east of the Portneuf River. Define relationship of the Portneuf River to the hydrogeologic units to the east and west.

6.4.1 Drilling

Drilling activities to be conducted as part of the geologic and subsurface soils investigation will be performed using drilling rigs capable of penetrating the various subsurface materials (consolidated and unconsolidated) present at the site. In addition, the drilling rigs will be capable of collecting unconsolidated soil samples using a Modified California Sampler or similar sampling tool.

The Plan anticipates 44 geologic borings will be drilled at the EMF site to various depths (ranging from approximately 50 to 300 feet below ground surface) and will be completed as groundwater wells. The geologic borings will either be drilled to a predetermined water-bearing zone or drilled to bedrock and the well completed in one of the water-bearing zones encountered. The Plan anticipates 26 of these borings will be completed as part of well pairs (i.e., one shallow boring and one deeper boring drilled in close proximity to each other) as shown in Figure 6-7. The well numbering system used in this plan is for convenience of description in the plan. A more appropriate well numbering scheme may be implemented in the field after well installation.

The preferred drilling methods are: percussion, air rotary, and mud rotary. The specific drilling method used will depend on the conditions anticipated at a given boring location.

The dual-wall percussion hammer drilling method entails use of a diesel-powered pile hammer to advance a boring through 9-5/8-inch diameter, dual-wall drive pipe. Compressed air, as the circulating medium, is directed down the annulus of the dual-wall drive pipe to the hammer bit. The method allows for a water mist to be added when needed to suppress dust. The compressed air lifts drill cuttings up the interior of the inner pipe to a cyclone separator mounted on the drilling rig. Drill cuttings collected in the cyclone separator are emptied to a receptacle at the ground surface, providing almost immediate feedback on materials penetrated by the hammer bit. Drill cuttings are thus collected for lithologic examination directly from the cyclone separator prior to discharge to the receptacle. The drive pipe maintains an open hole in loose, unconsolidated formations, minimizing both potential circulation losses and cross-contamination between water-bearing zones during drilling. A rapid penetration rate can be maintained under both normal and difficult drilling conditions (i.e., unconsolidated materials with boulders) and soil samples can be obtained during the drilling procedure. Air-rotary drilling with a down-hole hammer will be employed using the dual-wall pipe as a temporary conductor casing.

The mud-rotary drilling technique is an alternative to the dual-wall percussion hammer and air rotary methods. Mud-rotary will only be used as a last resort when hole conditions prevent completion of a boring to the desired depth using percussion or air rotary techniques. Rotary drilling in the unconsolidated materials underlying the EMF site would involve the use of a nominal 9-7/8-inch diameter, tricone drilling bit. A circulation fluid of mud (water) would be used to maintain an open borehole. A portable mud pit would be used to contain mud and drill cuttings. Temporary casing may be installed in the upper, unsaturated portion of the borehole, if required, to prevent possible caving of the sidewalls or possible loss of circulation.

6.4.2 Soil Sample Collection

Subsurface samples will be collected for physical analysis and lithologic description. When geologic borings are to be used for well pairs, samples will be collected from the deep boring only. Unconsolidated soil samples will be collected for physical analysis with a Modified California Sampler. The Modified California Sampler will be equipped with tubes to contain samples for analysis. Subsurface soil samples will be analyzed for grain size and percent moisture.

Samples will be collected for lithologic analyses from both drilling cuttings and subsurface samples. The lithologic characteristics of the soil samples and drilling cuttings will be described and logged by a geologist in accordance with the Unified Soil Classification System (USCS) (U.S. Department of Interior, 1985). The geologist will also note the depths at which groundwater is encountered during drilling, changes in drilling penetration rate, and other information pertaining to the drilling process.

Subsurface soil sampling will be limited to samples collected for geological characterization and physical analyses. Soil samples collected for geological characterization and physical analyses will be saved for possible metals analysis at a later date. QA/QC procedures will be followed for all soil samples collected.

6.5 GROUNDWATER INVESTIGATION

The groundwater investigation will provide information to further characterize the hydrogeologic conditions such as rate and direction of flow at the EMF site.

Investigation activities relating to the groundwater beneath the EMF site include well installation, groundwater sampling and analysis, aquifer testing, and water level monitoring. The locations of the new wells, existing monitoring and production wells, and other sampling points in the vicinity of the EMF site are shown in Figure 6-7.

Well locations have been selected based on the identification of data gaps during the review of existing information and prior investigations and the development of the conceptual site model. Wells will be screened at various depths, depending on the information that is required. Several well pairs have been located to assess the potential leakage of contamination to underlying water-bearing intervals. Variations in the concentrations of chemicals detected in samples collected from the wells will be monitored, and aquifer testing will be conducted. Information on static-water levels and groundwater chemistry will also be obtained. This information will be used to evaluate groundwater flow both laterally and vertically and will provide hydrogeologic and chemical data to supplement existing data. The hydrogeologic and chemical data will be reviewed to assess whether the proposed background wells are in fact representative of background conditions. This assessment will be accomplished by identifying hydrostratigraphic units and aquifer characteristics (i.e., permeabilities and hydraulic gradients) and reviewing groundwater chemistry trends (i.e., basic water types and chemicals of concern).

6.5.1 Geologic Borings to be Completed as Wells

Wells are to be completed in all the proposed geologic borings in accordance with State of Idaho (DWR, 1988) and EPA (EPA, 1975) guidelines. All geologic borings not completed as wells will be plugged and abandoned in accordance with the State of Idaho, Department of Water Resources regulations. Wells completed in the shallow, unconsolidated water-bearing interval will range in depth from approximately 50 to 100 feet. Wells completed in the deep unconsolidated waterbearing interval will range in depth from approximately 150 to 250 feet. Wells completed in bedrock material will range in depth from approximately 100 to 300 feet below ground surface. Conditions and target depths may change during the field investigation based on the ongoing analysis of the hydrogeologic environment during drilling. The locations of these wells are shown in Figure 6-7 and listed on Table 6-10. A summary of the drilling/well installation program is described below.

6.5.1.1 Wells to be Completed at the FMC Facility

A hydrogeologic site investigation was conducted and a groundwater monitoring program was developed at the FMC facility during the fall of 1990 (FMC, 1991b) which provided the basis for the identification of additional groundwater data needs at the facility for the proposed Phase I RI and field investigation. The proposed Phase I field investigation will provide information to: 1) better understand the hydrogeologic characteristics in the eastern section of the FMC facility and Bannock Paving area, and 2) further define groundwater contamination and potential source areas.

Fifteen wells at fourteen locations will be completed within the FMC facility boundaries south of Highway 30. Six borings will be drilled to bedrock to obtain hydrogeologic information. Three of these borings will be located in the west-central section of the facility. These borings will be completed as wells in the shallow, unconsolidated water-bearing interval. Four borings will be located in the western section of the facility around proposed RCRA Pond 16S; three borings will be located south-central section of the facility. These borings will also be completed as wells in the shallow, unconsolidated water-bearing interval. The remaining five borings will be located in the northeastern section of the facility. A well pair is proposed near the plugged and abandoned well FMC-2. This pair will be used to investigate the hydrogeology and vertical migration of contaminants, if any, within the bedrock and the deep, unconsolidated water-bearing intervals at this location. Three additional wells will also be located in this northeastern section of the site to delineate chemical migration in the shallow, unconsolidated water-bearing interval and to identify the extent of the contamination.

During the 1990 FMC field program, FMC learned that well TW-3S is perforated to the surface. For this reason, FMC plans to plug and abandon this well. Four new shallow wells (147, 148, 149, and 153) will be drilled in the area to meet groundwater monitoring requirements for a new RCRA unit (i.e., Pond 16S) for which construction is scheduled to begin in 1992. At least one of the four new wells will be an adequate replacement for the questionable background well TW-3S.

6.5.1.2 Wells to be Completed at the Simplot Facility

Additional monitoring wells will be installed and sampled at the Simplot facility to define hydrogeology and groundwater quality in the vicinity of the potential source areas identified in the conceptual model. The location of and rationale for each of these wells is described in Figure 6-7 and Table 6-10. Specific activities to be performed as part of the groundwater investigation are described below.

A total of 22 wells at 16 locations will be completed within the Simplot facility, south of Highway 30. The 16 locations are part of the geologic and soils investigation, and one boring at each location will be drilled to bedrock to obtain geologic and hydrogeologic information. Nine locations are situated upgradient and downgradient of the southernmost gypsum stack. These locations consist of single borings drilled into the underlying bedrock. These borings will be completed as wells to establish background water quality conditions and to define the extent of any groundwater contamination originating from the gypsum stack. Three of the proposed wells will replace PEI-1 and PEI-5 that must be decommissioned due to future expansion of the gypsum stack, and PEI-2 which can no longer be sampled due to casing displacement. The three wells to be replaced will be properly plugged and abandoned in accordance with State of Idaho (DWR, 1988) and EPA (EPA, 1975) regulations. A new well will be installed adjacent to PEI-3 to determine whether PEI-3 monitors a saturated zone above the suspected water table, an issue previously described in Section 3.3.3. It should be noted that existing well PEI-3 and new wells 300, 305 and 306 (see Figure 6-7) will also require abandonment within the next 1 to 2 years due to future expansion of the gypsum stacks. Until the time at which one or more of these wells requires abandonment, these wells will be sampled quarterly. (See Section 6.5.4 for discussion of quarterly groundwater monitoring program.)

Six additional proposed well locations are situated in and around the Simplot facility and consist of well pairs to define the extent of any groundwater contamination in shallow and deep water-bearing intervals. One deep well in the unconsolidated materials will be drilled and installed adjacent to well PEI-4 to supplement information on groundwater quality in the deep interval at this location.

6.5.1.3 *Wells to be Completed Outside of Facility Boundaries*

A total of 14 new wells is proposed at 8 locations outside the facilities' boundaries. Seven wells will be located between Highway 30 and the Portneuf River. Three of these locations are north of the FMC and Simplot facilities. The borings will be drilled to bedrock for lithologic identification. Wells will be completed in the first water-bearing interval in each boring. Information concerning water levels and quality will help to delineate the northern boundary of the EMF site. The remaining two locations are near the Portneuf River to investigate direction and movement of groundwater, groundwater quality, and interaction of the groundwater systems with the Portneuf River.

A total of six wells at three locations is to be completed as well pairs, east of the Portneuf River. The purpose of these wells is to better define groundwater movement and quality east of the river. These pairs, along with the two well pairs west of the river, will help to determine the hydrogeologic setting of the Portneuf River with respect to the groundwater systems in this area.

Conditions, number of wells, and target depths may change during the field investigation based on the ongoing analysis of the hydrogeologic conditions while drilling. Changes will be documented and reported in the Preliminary Site Characterization Report.

6.5.2 Well Installation

Groundwater wells, with the exception of pumping test wells, are to be constructed with 4-inch diameter, flush-jointed PVC riser casing and screen. Schedule 40 will be used in the construction of wells extending to a depth of 150 feet or less. Schedule 80 will be used in the construction of wells greater than 150 feet in depth. The screen will be manufactured or machine cut with transverse 0.020-inch slot.

The 0.020-inch screen slot size will be used for all 4-inch monitoring wells in all lithologies. This slot size was designed prior to FMC's 1990 RCRA field investigation based on lithologies encountered in prior investigations. This size was suitable for the conditions encountered at FMC and is expected to be suitable for the proposed wells.

Screen lengths will be 2 to 10 feet long within the uppermost water-bearing interval. Conditions encountered during drilling will dictate the placement of the screen interval and the length of the screen. Under no conditions will the screens and filter pack cross into two water-bearing intervals. Within the deeper water-bearing intervals in areas where contamination is not anticipated, the above conditions will be followed unless the water-bearing interval is of thickness greater than approximately 25 feet. In this case, well screen lengths in excess of 10 feet may be used depending on aquifer characteristics, field conditions, location of the well, and depth of the interval. No glues or solvents will be used during well installation.

With the use of the percussion and air-rotary casing drive methods, centralizers will not be needed. The inside diameter of the drive casing shall be between 6 and 9 inches. The well casing is installed inside the drive casing. The drive casing is removed as the filterpack and grout are installed, resulting in a straight well. The casing will be suspended and alignment checked to verify well installation.

During the drilling of well 144 and any other bedrock wells, the casing will be driven outside of the rotary or hammer bit hole and seated in the bedrock formation. Materials encountered will be circulated up, inside the casing. Upon seating into bedrock, casing advance will stop, and compressed air will be circulated to remove any residual material. Drilling will advance into the bedrock with only use of the bit. The casing will remain seated into the bedrock, sealing the hole from the unconsolidated formation and fluids. The outside casing will isolate the borehole from the unconsolidated materials, thus, with the use of the casing-drilling method, a cement seal is not required.

If used, centering devices will be placed surrounding the screen and at 50-foot intervals on the riser casing to the ground surface, as directed by the geologist. Once the casing and screen are lowered into the borehole, clean water will be pumped through the casing until the return flow is clear.

The annulus of each well will be packed with a clean, well-sorted silica filter sand. The filter sand will be placed with a tremie pipe or through the drive casing from the total depth of the boring to approximately 5 feet above the top of the screen. A bentonite slurry will be placed upon the filter pack interval or upon a fine sand above the filter pack interval. If problems with placing a bentonite slurry at depths are encountered, the fine sand interval will be increased and the grout seal will be placed directly on fine sand.

Type II Portland cement grout mixed with powdered bentonite will be tremied into the annular space above the seal. The grout will extend from the top of the seal to the ground surface. The well will also be checked for well alignment and/or the presence of obstructions by passing a 10-foot section of a 3-inch diameter PVC pipe or equivalent down the length of the well, to the top of the screen.

The surface completion of each well will consist of a 5-foot length of 8-inch diameter steel casing. Six-inch and eight-inch pumping test wells will be completed with a minimum of a 10-inch and 12-inch diameter steel casing, respectively. The steel casing will be grouted into place approximately 3 feet below the ground surface and will extend above the PVC riser casing. A cement pad will be constructed around each well installation. The cement pad will slope slightly away from the steel surface casing to promote drainage away from the well. Steel protective posts will be installed around each well in heavy traffic areas.

Wells in which pumping tests are performed will be constructed with 6-inch or 8-inch diameter, flush-jointed PVC riser casing and screen. Three wells (152, 312, and 321) are proposed for pumping tests in the shallow and the deep water-bearing intervals. The selection of these three wells for pumping tests will be reviewed as additional geological data are collected in the field. If wells 152, 312, and 321 are selected as the wells in which pumping tests are performed, schedule 40 PVC will be used in the construction of wells 152 and 312 and schedule 80 PVC will be used in the construction of well 321. The screens will be continuous slot with 0.050-inch openings in wells 152 and 312 and 0.030-inch openings in well 321. The filter packs will correspond to a 4-by-16-sized silica-sand in wells 152 and 312 and a 16-by-30-sized silica sand in well 321. The wells will be installed and completed in the same manner as described for the 4-inch monitoring wells.

6.5.3 Well Development

Following installation of the wells, each well will be developed. Development will be initiated not sooner than 24 hours and not later than 48 hours following completion of well-grouting activities. Development will be performed by bailing, airlifting, and/or pumping methods. It is anticipated that well development will be the responsibility of a separate crew working in tandem with drilling operations.

Well development will continue until the field parameters of temperature, pH, and electrical conductivity have stabilized and the well discharge appears clear and relatively free of sediment. Stabilization of the field parameters will be indicated by three consecutive measurements that are within 10 percent of one another for each parameter.

Following installation and development of each well the alignment of the PVC riser casing will be checked using the method described in Section 6.5.2. This method will determine if the well is straight and free of obstructions. Alignment will be tested following grouting and development of the wells, since these activities can also result in misalignment and/or obstructions.

6.5.4 Groundwater Sampling and Analysis

The groundwater monitoring program will include collection and analysis of samples from the new and existing wells listed in Table 6-11 at quarterly intervals (i.e., approximately every 3 months). The samples will provide information on the chemical characteristics of the water-bearing intervals beneath the EMF site.

A groundwater sample will be collected from each of the proposed wells listed in Table 6-11 at the completion of well development. When all proposed wells have been installed and developed, samples will also be collected from each of the existing wells in the network. Although this approach to the first round of sample collection may extend sample collection over a period of 2 to 3 months, FMC and Simplot believe the advantages of obtaining new groundwater quality data as soon as possible outweighs the disadvantage of collecting samples over an extended period of time. (See Section 8 for estimated duration of Phase I drilling program.) The second round of sampling, which will include analysis of samples for all analytical parameters listed in Table 6-12, will take place when FMC and Simplot would otherwise be conducting their current quarterly groundwater monitoring programs (i.e., September 1992). The second and all subsequent rounds of groundwater monitoring can and will be conducted over a much shorter period of time (on the order of a few weeks) than the initial round.

The Kinport, Williamson, Lindley, Tank Farm and Rowland wells are included in the EMF site monitoring network (see Table 6-11). However, these wells were not constructed for monitoring purposes, and in many cases completion information is not available. The results may be inappropriate, confusing, or misleading. The Kinport well is completed in a formation which does not appear to be present beneath the EMF site. Therefore, data from this well may be of particularly limited value. The appropriateness of these wells for monitoring wells will be revisited after three rounds of quarterly groundwater monitoring.

First round groundwater samples will be analyzed for heavy metals and general water-quality parameters, including major cations and anions. Groundwater samples will also be analyzed for gross alpha and beta, and for radium-226 and 228 if gross alpha or beta levels exceed levels reported for samples from upgradient wells. A specific list of these inorganic and radiological parameters is provided in Table 6-12.

Heavy metal analyses will be performed on unfiltered aliquots of the first groundwater sample taken from each of the proposed wells and from each of the existing wells (see Table 6-11). If the samples collected are turbid, both filtered and unfiltered samples will be collected.

Second round samples from all wells located upgradient of the two facilities, and from selected downgradient wells screened in the shallow water-bearing interval, will be analyzed for EPA volatile and semivolatile organic priority pollutants in addition to the inorganic and radiological parameters described above. Organic analyses will be deferred to the second round of sampling because of the extended period of time over which the first round of samples will be collected. The selected downgradient wells include at least one well immediately downgradient of each of the potential sources of groundwater contamination identified in the conceptual

Table 6-11
GROUNDWATER SAMPLING LOCATIONS

Location	Existing Wells			Proposed Wells	
FMC Facility[a]	TW-3D	107	122	139	
	TW-5S	108	123	140	
	TW-5I	109	124	141	
	TW-5D	110	125	142	
	TW-9S	111	126	143	
	TW-10S	112	127	144	
	TW-11S	113	128	145	
	TW-11I	114	129	146	
	TW-12S	115	130	147[c]	
	101	116	131	148[c]	
	102	117	132	149[c]	
	103	118	133	150	
	104	119	134	151	
	106	120	135	152	
		121	136	153[c]	
			137		
Simplot Facility	PEI-1[b]			300[b]	311
	PEI-3[b]			301	312
	PEI-4			302	313
	PEI-5[b]			303	314
	PEI-6			304	315
				305[b]	316
				306[b]	317
				307	318
				308	319
				309	320
				310	321
Outside Facility Boundaries	Old Pilot House	Kinport		500	507
	New Pilot House	Williamsen		501	508
	Frontier	Lindley		502	509
		Rowland		503	510
		Tank Farm		504	511
				505	512
				506	513

Notes:

(a) Wells were not installed in borings TW-6, 105, and 138. Wells FMC-2, TW-1S, TW-7S, and TW-8S have been plugged and abandoned. TW-2 and TW-4 are operational but no longer used for monitoring. (FMC, 1991a)

(b) Wells PEI-1 and PEI-5 will be sampled in the first round of quarterly monitoring only. Thereafter, they will be plugged and abandoned. Well PEI-3 and new wells 300, 305 and 306 will also require abandonment within 1 to 2 years due to future expansion of the gypsum stack. Until the time at which one or more of these three wells requires abandonment, the wells will be sampled quarterly.

(c) These are RCRA-required upgradient and downgradient monitoring wells to be installed during construction of Pond 16S.

Table 6-12
ANALYTICAL PARAMETERS
GROUNDWATER SAMPLES

I. Heavy Metals	**IV. Volatile Organics[b]**
Aluminum	Chloromethane
Antimony	Bromomethane
Arsenic	Vinyl Chloride
Barium	Chloroethane
Beryllium	Methylene Chloride
Boron	Acetone
Cadmium	Carbon Disulfide
Chromium	1,1-Dichloroethene
Cobalt	1,1-Dichloroethane
Copper	Trans-1,2-Dichloroethene
Iron	Chloroform
Lead	1,2-Dichloroethane
Lithium	2-Butanone
Manganese	1,1,1-Trichloroethane
Mercury	Carbon Tetrachloride
Nickel	Vinyl Acetate
Selenium	Bromodichloromethane
Silver	1,2-Dichloropropane
Thalium	cis-1,3-Dichloropropene
Vanadium	Trichloroethene
Zinc	Dibromochloromethane
	1,1,2-Trichloroethane
II. General Water Quality Parameters	Benzene
Alkalinity (bicarbonate)	Trans-1,3-Dichloropropene
Alkalinity (carbonate)	2-Chloroethylvinylether
Ammonia	Bromoform
Calcium	4-Methyl-2-Pentanone
Chloride	2-Hexanone
Conductivity	Tetrachloroethene
Fluoride	1,1,2,2-Tetrachloroethane
Magnesium	Tetrahydrofuran
Nitrate	Toluene
pH	Chlorobenzene
Phosphorus (total)	Ethylbenzene
Phosphorus (orthophosphate)	Styrene
Potassium	Total Xylenes
Sodium	
Sulfate	**V. Semivolatile Organics[b]**
Temperature	Phenol
Total Dissolved Solids	bis(2-Chloro-ethyl)ether
	2-Chlorophenol
III. Radionuclides	1,3-Dichlorobenzene
Gross Alpha	1,4-Dichlorobenzene,
Gross Beta	Benzyl alcohol
Radium-226, Radium-228[a]	1,2-Dichlorobenzene
	2-Methylphenol

Notes:

See page 6-99.

Table 6-12 (Cont'd)

VII. Semivolatile Organics (Cont'd)	
bis(2-Chloroisopropyl)ether	4,6-Dinitro-2-methylphenol
4-Methylphenol	N-Nitrosodiphenylamine
N-Nitroso-dipropylamine	4-Bromophenyl phenyl ether
Hexachloroethane	Hexachlorobenzene
Nitrobenzene	Pentachlorophenol
Isophorone	Phenanthrene
2-Nitrophenol	Anthracene
2,3-Dimethylphenol	Di-n-butyl phthalate
Benzoic acid	Fluoranthene
bis(2-Chloroethoxy)methane	Pyrene
2,4-Dichlorophenol	Butyl benzyl phthalate
1,2,4-Trichlorobenzene	3,3"-Dichlorobenzidine
Naphthalene	Benzo(a)anthracene
4-Chloroaniline	bis(2-Ethylhexyl)phthalate
Hexachlorobutadiene	Chrysene
4-Chloro-3-methylphenol	Di-n-octyl phthalate
2-Methylnaphthalene	Benzo(b)fluoranthene
Hexachlorocyclopentadiene	Benzo(k)fluoranthene
2,4,6-Trichlorophenol	Benzo(a)pyrene
2,4,5-Trichlorophenol	Indeno(1,2,3-c,d)pyrene
2-Chloronaphthalene	Dibenzo(a,h)anthracene
2-Nitroaniline	Benzo(g,h,l)perylene
Dimethyl phthalate	(1-methylethyl)-Benzene
Acenaphthylene	
3-Nitroaniline	
Acenaphthylene	
2,4-Dinitrophenol	
4-Nitrophenol	
Dibenzofuran	
2,4-Dinitrotoluene	
2,6-Dinitrotoluene	
Diethyl phthalate	
4-Chlorophenyl phenyl ether	
Fluorene	
4-Nitroaniline	

Notes:

(a) Groundwater samples will be analyzed for radium-226 and radium-228 only if gross alpha or beta levels exceed levels reported for samples from upgradient wells.

(b) Groundwater samples will be analyzed for volatile and semivolatile organic compounds during the second round of groundwater monitoring because of the extended time in which groundwater samples will be collected during the first round.

model (see Figure 4-1) and the potential sources of shallow soil contamination previously tested for organics (i.e., FMC's chemical laboratory drainpit, waste oil storage area, and transformer storage area; FMC, June 1991b). The selected downgradient wells also include a well downgradient of the Simplot landfill. In 1980, an attempt was made to install a groundwater monitoring well upgradient of the FMC landfill. (During the 1990 FMC field program, a boring was drilled downgradient of the FMC landfill. The boring was extended to a depth of approximately 165 feet. No appreciable water was encountered in the attempts to install monitoring wells upgradient and downgradient of the FMC landfill as described in Section 4.2.1.) The list of specific wells to be tested for organics is provided in the Sampling and Analysis Plan (Bechtel, 1992a). The analysis of groundwater samples for volatile/semivolatile organic compounds will be discontinued in future rounds should results indicate the organics are below detection limits and/or levels of concern.

A specific list of groundwater analytical parameters is provided on Table 6-12. At least three quarterly rounds of groundwater data must be collected from any one well before the data are considered representative of groundwater quality from the well's screened interval and location. After the first three rounds of groundwater monitoring, FMC and Simplot may request discontinuation of testing for analytes which are rarely if ever detected and/or which are consistently detected below levels of concern.

6.5.5 Aquifer Testing

Aquifer testing will be conducted in selected wells to assess characteristics of water-bearing intervals occurring beneath the EMF Site. The well testing will be performed after installation and development of the wells. Field methods used to determine aquifer characteristics will include pumping and slug tests.

Transmissivity, hydraulic conductivity, and storativity are the parameters to be calculated using data collected from aquifer testing. The hydraulic gradient of each water-bearing zone will be calculated from water-level data obtained during the field program. The aquifer parameters calculated will be used to evaluate groundwater velocity and flow direction and to assess the degree of hydraulic connection both laterally and vertically within the saturated materials.

6.5.5.1 Pumping Tests

Two pumping tests are planned at the Simplot facility. A pumping test for the shallow unconsolidated water-bearing interval will likely be conducted just west of the facility complex in well 312. This location was selected due to a possible transition of geologic and hydrogeologic conditions within the unconsolidated materials as well as their locations downgradient of the Simplot gypsum stack and the FMC calciner ponds. The other pumping test is planned for a deep unconsolidated water-bearing interval, downgradient of the Simplot facility in well 321. This location was selected based on the proximity of nearby observation wells. The wells in which pumping tests are currently planned may be changed as additional geologic/hydrogeologic data are collected in the field.

Two pumping tests were conducted in the western portion of the FMC facility during the 1990 field program (FMC, 1991b), one in the shallow and one in the deep, unconsolidated water-bearing interval. A pumping test is planned at the FMC facility at well 150 located near Pond 8S.

A constant discharge and/or a step-drawdown test will be performed in each pumping well for a maximum of 24 hours. Discharge rates and drawdown will be monitored and recorded for the pumping well. Drawdown will also be initially monitored in nearby wells to assess whether they are within the radius of influence of the pumping well. If no drop in water-level is observed during testing, monitoring of these wells will be discontinued. Upon completion of a pumping test, recovery of water-levels in the pumping and observation well(s) will be monitored for a maximum of 24 hours.

6.5.5.2 *Slug Tests*

Slug tests will be performed in approximately 25 wells. Although slug tests are more suited for low-permeability materials, unlike what is anticipated at the EMF site, important hydraulic parameters can be determined especially since only a limited number of pumping tests can be performed. Furthermore, slug tests will be conducted at each well in which a pumping test is performed to enable comparison of results. The specific locations for wells designated for slug testing will be based on hydrogeologic data collected during drilling and development activities. Slug tests will be located throughout the EMF site to examine hydrogeologic conditions both laterally and vertically. These tests will be combined with results from the 1990 field program at FMC (1991b). Approximately half of the wells selected for slug tests will be located in shallow monitoring wells near potential source areas. The remaining well locations may be selected to include both shallow and deep wells representative of varying subsurface conditions underlying both plant facilities and locations beyond the plant boundaries.

6.5.6 Surveying

Horizontal coordinates and elevations of the proposed wells will be surveyed on the basis of the State of Idaho Grid System. Elevation will be measured at a point, marked and notched on each of the well's PVC riser casing. This point will be used for water-level measurements for that well. Both horizontal coordinates and ground-surface elevations will be surveyed. Borings not previously surveyed during the 1990 field program conducted at the FMC facility (Borings B4, B5, B11, B138) will also be surveyed, as well as any test wells and production wells for which survey data cannot be validated. In addition, three to five locations along the Portneuf River will also be surveyed. River level elevations will be measured from these locations during the water-level monitoring program.

6.5.7 Thermal Investigation

Previous investigators have identified linear surface features within the region surrounding the EMF site. These investigators have hypothesized that a geothermal system, related to the surface features, may be present beneath the EMF site. Morrison-Knudsen (M-K, 1989) stated that geothermal waters may be migrating through fault, fracture zones, and permeable units, mixing with the groundwater monitored by this well due to the temperature characteristics of the water from the Old Pilot House Well and its proximity to linear surface features. Morrison Knudsen postulated that the geothermal mixing could be the source of elevated inorganic compounds sampled in the groundwater. Geraghty and Miller (1982a) also identified a thermal groundwater plume, but postulated the source could be from the FMC furnace building and/or slag pit.

6.6 SURFACE WATER AND SEDIMENT INVESTIGATION

The primary objective of the surface-water/sediment investigation is to assess the impacts of the two facilities, if any, and where they can be identified, on the Portneuf River (i.e., impacts resulting from surface discharges to the river). The potential for groundwater impacts on the river are best assessed by investigating groundwater hydraulics and quality in the immediate vicinity of the river.

A surface water and sediment investigation will be conducted to collect the data needed to identify potential contamination migration pathways in the area north of the FMC and Simplot facilities. FMC currently discharges non-contact cooling water from the IWW ditch to the Portneuf River under NPDES Permit #ID-00022-1. Simplot also discharged effluent from its water treatment ponds to the river until 1980. The nutrient-rich effluent is now collected and sold for irrigation and fertilization.

The surface water and sediments investigation will include defining the drainage patterns onto and off of the two facilities to verify the assumption that there is no surface drainage pathway exiting either facility. A ground survey and aerial mapping will be conducted to determine drainage patterns at the EMF site. A limited sampling and analysis program will also be performed to assess surface water quality in the Portneuf River and/or associated ponds and springs. The Phase

I sampling and analysis program will be limited to a 10-mile segment of the Portneuf River from river mile 10 to river mile 20. (See Figure 6-8.)

6.6.1 Surface Water Sample Collection

A summary of samples to be collected for the surface water investigation is presented on Table 6-13. The locations of the surface water samples are shown on Figure 6-8. Specific locations will be subject to in-field verification.

Samples of river water will be collected at selected locations along a 10-mile water segment from river mile 10 to river mile 20. This segment extends both upstream and downstream of the EMF site. Sampling will be conducted upstream and downstream of the Pacific Hide and Fur Recycling and Union Pacific Railroad Co. NPL sites to assess other impacts on river water quality and sediments and to establish a baseline for surface water quality and sediment upstream of the EMF site. In addition, water samples will be collected from major springs along both sides of the Portneuf River. Surface water samples will also be collected from ponds along the Portneuf River at the fish hatchery and creamery.

Flow rates of the Portneuf River in the vicinity of the EMF site will be measured to evaluate seasonal changes in flow as well as changes with distance along the river. Other surface water features, such as irrigation returns and other discharges to the river, will also be identified during the Phase I surface water investigation.

6.6.2 Sediment Sample Collection

Sediment samples will be collected downstream of the EMF site starting at Portneuf River mile 10 and ending upstream of the EMF site at Portneuf River mile 20. In addition, sediment samples will be collected at selected locations along the 10-mile segment of the Portneuf River. A summary of sediment samples to be collected is presented on Table 6-13. Sediment sample locations are shown on Figure 6-8. In general, sediment samples will be taken in conjunction with and in the immediate vicinity of the surface water samples. Sediment samples will be collected in backwaters where suspended soils would tend to be deposited. Sediment samples

Table 6-13
SURFACE WATER AND SEDIMENT INVESTIGATION

Location No.	Sampling Location	Springs	River	Pond	Sediment
1	River Mile 10		X		X
2	Eastern Springs of Pair in Section 36	X			X
3	River at Siphon Road		X		X
4	Springs near Siphon Road	X			X
5	Fish Hatchery River Discharge		X		X
6	Fish Hatchery - Pond			X	X
7	Fish Hatchery - Springs	X			X
8	River FMC Park Discharge		X		X
9	FMC Park Springs - South	X			X
10	River at Batiste Springs Discharge		X		X
11	Batiste Springs Downstream of Creamery			X	X
12	Springs Near Rowland Creamery	X			X
13	River at STP Discharge		X		X
14	Springs Near Sewage Treatment Plant	X			X
15	Batiste Springs	X			X
16	Springs Near Batiste Road	X			X
17	River at Batiste Road		X		X
18	River at Old Simplot Discharge				X
19	River at FMC Current Discharge		X		X
20	River at Old FMC Discharge				X
21, 22	River in the Vicinity of the Gypsum Stack		XX		XX
23	River Upstream of Gypsum Stacks		X		X
24	River Mile 15		X		X
25	River Downstream of Pacific Hide/ Union Pacific Railroad Sites		X		X
26	River Upstream of Pacific Hide/Union Pacific Railroad Sites		X		X
27	River Upstream of The City of Pocatello		X		X

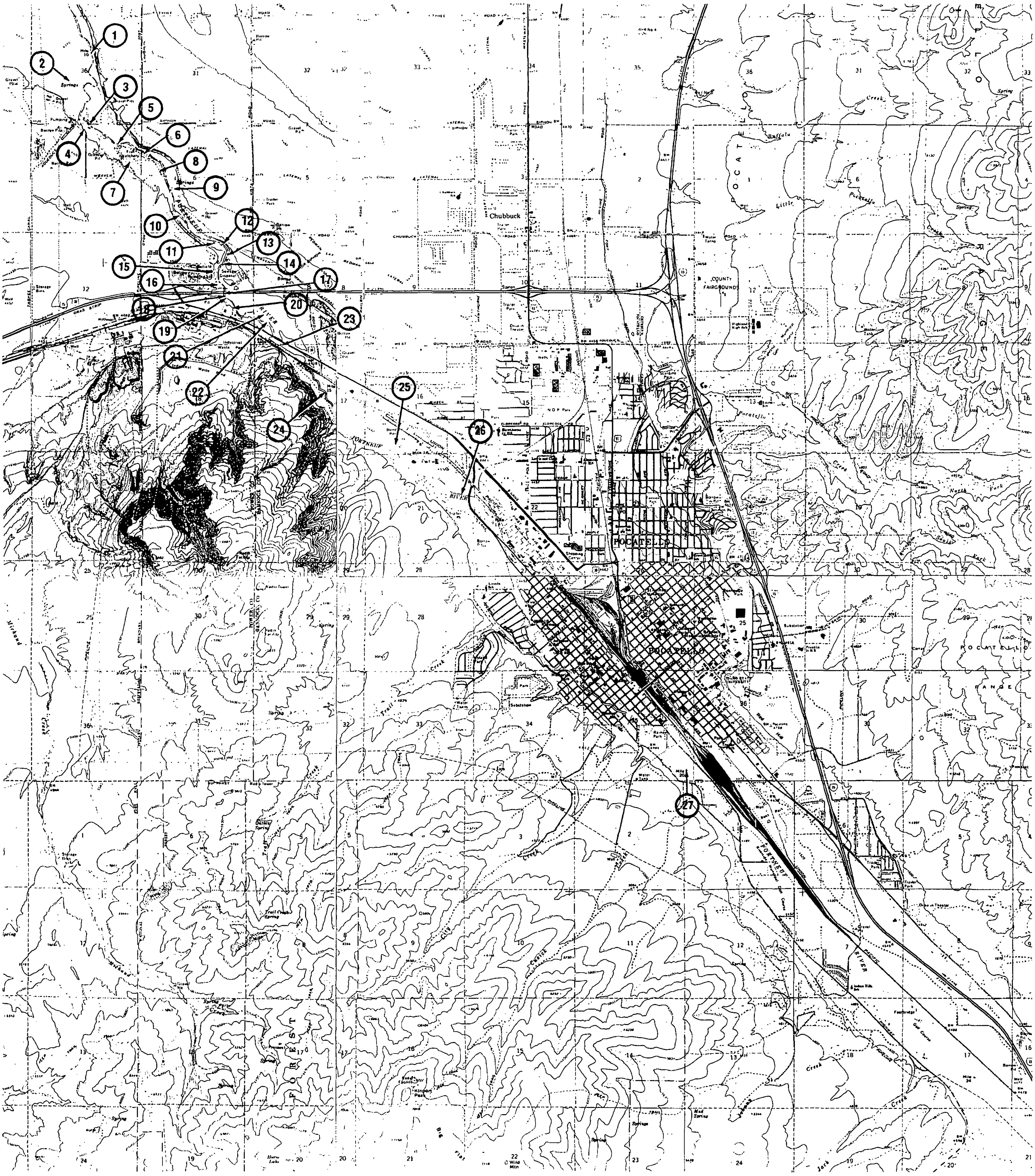

Figure 6-8 Surface Water and Sediment Sampling Locations

will be collected at a depth of 0 to 6 inches below the river or spring bottom using a hand sediment sampler. Cores will not be required to obtain samples at this depth.

6.6.3 Surface Water and Sediment Sample Analysis

Surface water samples will be analyzed for heavy metals, radioactivity, and basic water quality parameters, including major cations, anions, and dissolved oxygen. Both filtered and unfiltered surface water samples will be submitted for metals analyses to assess both suspended and dissolved constituents. The specific list of analytes for which surface water samples will be tested is provided in Table 6-6.

Sediment samples will be analyzed for heavy metals and radioactivity. In addition, sediment samples will be analyzed for PCBs. A specific list of sediment analytes is provided in Table 6-14.

6.6.4 Data Collection and Evaluation

Prior to conducting the field investigation, a review of the existing maps and photographs will be reviewed and a sample location map of the Portneuf River and its environs will be prepared. The base map will locate the various springs and specific discharges into the river. Data on effluents and water quality will be collected and summarized to establish a general water quality baseline. The Phase I field investigation will then be used to determine the presence of contaminants, if any, and their concentration in the springs, ponds, discharges and river itself. Similar data will be collected and evaluated for sediments.

As indicated in Section 6.1.3, the data obtained in the groundwater and subsurface soil investigation will be integrated with the data obtained in the potential source investigation to develop an overall site model. These data will be used to characterize the subsurface conditions in and adjacent to the FMC and Simplot facilities, to evaluate the impact of the facilities on the subsurface soils and groundwater, to identify areas which may require remediation, and to develop candidate technologies appropriate to the remediation if required.

Table 6-14
ANALYTICAL PARAMETERS
SEDIMENT SAMPLES

I. Heavy Metals	**II. General Mineral**
Aluminum Antimony Arsenic Barium Beryllium Boron Cadmium Chromium Cobalt Copper Iron Lead Lithium Manganese Mercury Nickel Molybdenum Selenium Silver Thallium Vanadium Zinc	Fluoride Phosphorus (total) Phosphorus (orthophosphate) **III. Radioactivity** Gross Alpha Gross Beta Gamma Spectroscopy **IV. PCBs** Aroclor 1016 Aroclor 1221 Aroclor 1232 Aroclor 1242 Aroclor 1248 Aroclor 1254 Aroclor 1260 **V. OTHER** pH Total Organic Carbon

Data will be presented as described in Section 6.1.3. It is probable that numerical modeling, with two-dimensional and possibly three-dimensional models, will be used for evaluation of groundwater flow rates, direction of flow, and impact of the facilities on the groundwater chemistry. Models will also be used in any evaluation of candidate remedial technologies on groundwater chemistry (if applicable).

6.7 LAND USE AND SOCIOECONOMIC SURVEY

To identify the potential receptors of any contaminants originating from the facilities, a survey of groundwater usage, land use and populations in the vicinity of the site will be performed. Land use and socioeconomic data previously collected for FMC as part of the FMC Facility Assessment (FMC, 1991b) will be reviewed and augmented as necessary to identify individual resident and community drinking water and irrigation supply wells, to classify land uses (e.g., agricultural practices, residential, commercial, industrial), and to identify hospitals, schools, and senior citizen home and other facilities occupied by sensitive populations. Land use and socioeconomic information will be collected principally from relevant city, county and state agencies.

The information collected will be made available to the EPA for use in preparation of the EMF Site Risk Assessment.

6.8 ECOLOGICAL SURVEY

The main objective of this portion of the remedial investigation (RI) is to collect data on the terrestrial and aquatic biological resources on and in the vicinity of the EMF site that will be made available to the EPA for use in preparation of the EMF Site Risk Assessment. FMC and Simplot will work closely with EPA to ensure that data needs for the Risk Assessment are adequately met by the sampling program. In keeping with the phased approach to the EMF site remedial investigation, Phase I will concentrate on areas close to the facilities, e.g., upstream of American Falls Reservoir. Any additional investigations which may be needed based on the findings of the ecological risk assessment, would include sampling, with performance of subsequent biological studies contingent upon the results of previous work. The first phase will consist of collection and verification of existing information concerning the ecological environment in and around the EMF site. If sensitive or significant biological resources are indicated by the ecological surveys in Phase I and other Phase I Activities indicate that contamination may be emanating from the facilities by one or more pathways for which the biota are receptors, additional investigations may be triggered. At the conclusion of Phase I, if data gaps and/or a pathway of exposure directly related to the EMF site is identified, additional investigations will be undertaken. Based on the findings, a sampling plan with specific objectives will be developed and forwarded to EPA as a technical memorandum. This may include work outlined in Section 6.8.2.

Phase I will consist of identification of the fish and wildlife populations in the vicinity of the lower Portneuf River and the EMF site. Via further review of existing information and field reconnaissance conducted, the following specific information will be developed:

- Identification of sensitive species (e.g., special status species, species targeted for human consumption) and habitats (wetlands, riparian areas) in the immediate vicinity of the EMF site
- Identification of fish and wildlife species of recreational value
- Historic use of these areas and population trends within them for sensitive species of all types (plants, wildlife, fish)
- Approximate amount and vulnerability of designated critical habitat for threatened or endangered species
- Spatial/geographic distribution of habitat types present
- Qualitative assessment of diversity of affected habitat types
- The need, if any, for further study of any sensitive or unique resources
- The recommended scope and approach for Phase II.

FMC and Simplot recently obtained a copy of an ecological study which may be of particular relevance to this site. The city of Pocatello undertook an extensive survey of aquatic biota in the vicinity of its discharge to the Portneuf River as summarized in Section 3.1.7. These studies were conducted in 1988 and 1989 in conjunction with Dr. G. Wayne Minshall's Stream Ecology Center at Idaho State University and the Tribal Fisheries Department of the Shoshone-Bannock Tribes. The data generated by this study will be carefully reviewed before additional aquatic field sampling is considered.

6.8.1 Phase I Scope of Work

A literature review and site survey will be conducted during the first phase of the ecological survey at the EMF site to identify important ecosystems in the site vicinity and briefly describe their species components and interrelationships. The survey will be performed by reviewing existing information and confirmed by site inspection.

Potential sources of information include published scientific literature, ground and aerial surveys, land use and water use surveys, and federal wildlife reports. In addition, unpublished reports from FMC, Simplot, Idaho Fish and Game, and Idaho State University will be collected and reviewed to the extent possible. Data obtained from the review of existing information and the site inspection will provide a general identification of the flora and fauna in and around the site with particular emphasis placed on identifying species with key ecological functions, sensitive environments, endangered species and their habitats, and species in the human food chain. This review will also identify potential contributors to contaminant generation such as discharges and various land uses. It will be important to note that the presence or absence of certain taxa may be due to past environmental perturbations from the EMF site or other sources. The information collected will be made available to the EPA for use in preparation of the EMF Site Risk Assessment.

It is recognized that the permitted discharges from the EMF site into the Portneuf River have occurred both downstream and upstream of a number of municipal and industrial facilities. However, Simplot discontinued their discharges in 1980 and FMC currently discharges non-contact cooling water to the river. Potentially significant offsite sources of impact on water quality of the Portneuf River include permitted industrial discharges, urban runoff, wastewater from a sewage treatment plant, unregulated domestic sewage, and agricultural runoff. Terrestrial resources may be impacted by agricultural practices, such as the application of pesticides, and by emissions from other industrial or urban facilities. Therefore, unless key or marker contaminants are encountered and verified as originating definitively from only the EMF site, it will be difficult at best, and may not be possible, to conclusively determine a cause and effect scenario.

Based on existing information and preliminary field surveys (reconnaissance observations), specific biological resources that may be environmental receptors of constituents of concern originating from the EMF site will be identified. Resources will be quantified to the extent possible from existing information and limited field reconnaissance. The scope and breadth of the subsequent field surveys will be dependent on the completeness of the existing information and will be outlined in the technical memorandum. If significant data gaps are found, a more extensive program may be required to provide an adequate adequate database of information for the biological sources. Major elements that will be identified include threatened and endangered species; fisheries and aquatic resources, riparian vegetation, and wildlife.

Existing information will be reviewed to determine the nature, status, and extent of the available data pertinent to the EMF site and surrounding area. A preliminary review of existing information has already been conducted and summarized in Section 3. The review of the existing information will include the following elements:

- Conduct a literature and database review for the EMF site and surrounding area supported by contacts with local authorities in agencies and in the academic community. Unpublished reports from FMC, Simplot, Idaho Department of Fish and Game, and Idaho State University will also be collected and reviewed.

- Assess the presence of special-status species or sensitive habitats. Special status species include those listed as threatened or endangered by the state or federal governments and species that are candidates for listing, such as the sage grouse. Sensitive habitats include wetlands, vernal pools, stream riparian zones, critical habitat designated for threatened or endangered species, and special habitats designated by state and federal agencies.
- Determine the status and occurrence of all sensitive plant and animal species. Search state databases, such as the Idaho Natural Heritage Program, if available and accessible, for records of known occurrence for sensitive species and habitats within the EMF site and surrounding area. Verify with state resource officials and request any additional information.
- Develop a working list for all rare plant and animal species known to occur or with potential to occur within the EMF site and surrounding area.
- Conduct a preliminary review of jurisdictional wetlands. Review the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) maps, Soil Conservation Service surveys, USGS topographic maps, and other relevant information. Estimate approximate areal extent; characterize wetlands by type (e.g., riparian woodlands, herbaceous marsh, vernal pool, etc.); and interpret the vulnerability of key wetland functional values (such as wildlife habitat, water quality) to contamination.
- Review pertinent fisheries (commercial and recreational) data and publications. Summarize existing fisheries data and evaluate trends in use, population abundances, and structure.

A site reconnaissance survey will be conducted in Phase I of the ecological study after review of the existing data. The survey will be qualitative in nature aimed at identifying potential receptor species and will be composed of the following tasks:

- Conduct general reconnaissance by foot and vehicle of habitats and species of concern, recording important habitat information on topographic maps of the area. This will include both terrestrial and aquatic habitats. Ecological reconnaissance techniques will be designed so as to avoid any possible adverse impacts to the sage grouse and/or its environment.
- Identify and map areas of biological importance and potential occurrence of sensitive species, and assess wildlife use of habitats.
- Assess the general condition of terrestrial and aquatic habitats, taking note of particularly stressed areas.

- Search for evidence of special status plants and animals in the onsite habitats with the greatest potential to support them. If species are not observed, the potential for their presence will be evaluated.
- Evaluate the quality, extent, and functional value (e.g., the value of the wetlands for nutrient cycling, entrapment of sediment, or use as wildlife habitat) of wetlands and riparian vegetation. Verify the presence and general location of jurisdictional wetlands on or in the vicinity of the facilities.
- Based on the aforementioned data sources, determine the likelihood that special status species or sensitive habitat may have been affected by the facilities.

Vegetation and Wetlands. Vegetation and wetlands will be assessed through visual inspection using approved methodologies. It is preferable to observe wetlands in the appropriate season to take advantage of the hydrological characteristics. The exact timing of the surveys will be coordinated with the appropriate agencies and landowners and is expected to be in the spring. Surveys will provide field verification or "ground-truthing" of existing information (e.g., verification of National Wetland Inventory maps). The results of the field surveys will be mapped on small-scale aerial photographs or similar topographic maps.

Wildlife. Wildlife use of the EMF site and vicinity will be visually noted and will be timed to the appropriate portion of the season for maximum visibility. Special notice will be taken of the presence and use by raptors and waterfowl. Survey methods for raptors should coincide with nesting season of specific raptor species. Field personnel will note the presence of raptor feathers, pellets, whitewash, prey remains, and other signs of nesting. Special consideration will also be given to the presence of colonial nesting waterbirds, such as black-crowned night herons and double-crested cormorants. These species are known to nest in the area, high on the food chain, sensitive to environmental contaminants, and indicators of environmental health.

Aquatic Biota. Aquatic biota will be qualitatively assessed through detailed review of all available literature, pertinent to the EMF site. As discussed previously, the City of Pocatello Sewage Treatment Plant report will be of particular importance in this review.

6.8.2 Phase II Scope of Work

A subsequent ecology study may be developed on the basis of the data generated during the first phases of various studies within the RI (e.g., Phase I of the ecological study and Phase I of the groundwater, surface water, and sediment investigation). The Phase I data from these studies will provide information on possible exposure pathways, receptor populations, and extent of media contamination. Depending on the results from the first phases of the RI, further biological investigations and analyses may be appropriate.

Aquatic sampling could be conducted at locations also selected for surface water and sediment collection. In addition, the stations could be chosen to be as close as possible to locations used in previous ecological investigations. The stations selected may be sampled for algae, benthic invertebrates, and fishes to the level of detail commensurate with the purposes of this investigation. Aquatic macrophytes, macroscopic algae, periphyton, and fisheries may be qualitatively or quantitatively assessed.

7. Project Management Approach

Section 7

Project Management Approach

This section outlines the project management approach to be used in conducting RI/FS work for the Eastern Michaud Flats (EMF) site under CERCLA. Because the RI/FS is being conducted by FMC and Simplot (the Respondents) under a signed AOC, the EPA guidance has been modified as appropriate. This section defines the Respondents' responsibilities, procedures for coordination with EPA and others, and the general philosophy of project management and control to be utilized throughout the duration of the RI/FS effort. It is intended that this document be fully consistent with and responsive to the AOC. In the event of any inconsistencies, the directions contained in the signed AOC and SOW will take precedence.

Project management directives are used to outline working relationships and to define responsibilities for selected tasks and activities. A well-conceived management plan is especially important for the EMF site because of the need to integrate the wide variety of technical and legal staff involved for each of the Respondents with that of the contractor's project management team. In addition, there are a host of concerned entities involved outside of the direct RI/FS project team. These entities include the EPA and the EPA oversight contractor, the Idaho Department of Health and Welfare (IDHW); the Shoshone-Bannock Tribe; various federal agencies (e.g., U.S. Fish and Wildlife Service, U.S. Department of Interior); and various community representatives/committees, all of whom will play important roles as the RI/FS proceeds. The interaction of these diverse entities will be a major effort that will require ongoing definition as the project progresses. Consistent with the AOC, two individuals, one from each Respondent, have been designated as Project Coordinators, with responsibility for overseeing the implementation of the AOC. Further details on organization, responsibilities, staffing, and controls are provided as follows.

7.1 RI/FS PROJECT ORGANIZATION AND STAFFING

The production tasks associated with performance of the RI/FS are being conducted by Bechtel Environmental, Inc. (BEI) under contract to FMC and Simplot. A

Potentially Responsible Party (PRP) Committee consisting of the designated Project Coordinator from each company provides joint direction to the RI/FS Contractor (BEI). The PRP Committee will be supported as necessary by the engineering, environmental, legal, and administrative staff of each of the individual companies. An overall organization chart is shown in Figure 7-1. The RI/FS work tasks and preparation of the AOC deliverables will be overviewed by the PRP Committee, which will also be the contact and coordination point for all communication with the EPA. Bechtel Environmental, Inc. is responsible to the PRP Committee for conducting and/or managing the various work tasks, including the work of subcontractors, as shown on the organization chart. At this point, subcontract needs in the areas of drilling, sampling, analytical, and aerial survey services have been identified; others may be added as project scope develops. The EPA retains responsibility for communication and coordination with all off-project entities, including but not limited to the EPA oversight contractor and the Technical Advisory Group (TAG).

Figure 7-2 presents the project organization chart for the direct RI/FS project team (Respondent plus contractor representatives) and indicates the key individuals for each company. The roles and responsibilities of the various individuals and entities are presented in the following subsections.

7.1.1 FMC Corporation

The FMC Corporation is represented on the PRP Committee by Mr. James P. Sieverson, who serves as Environmental Manager for FMC. Other key members of the FMC team include:

Key FMC Staff	Title/Area of Responsibility
Pamela S. French	Sr. Environmental Engineer
Ron R. Hosking	Contract Coordinator
William S. Moore	Division Manager Environmental Affairs

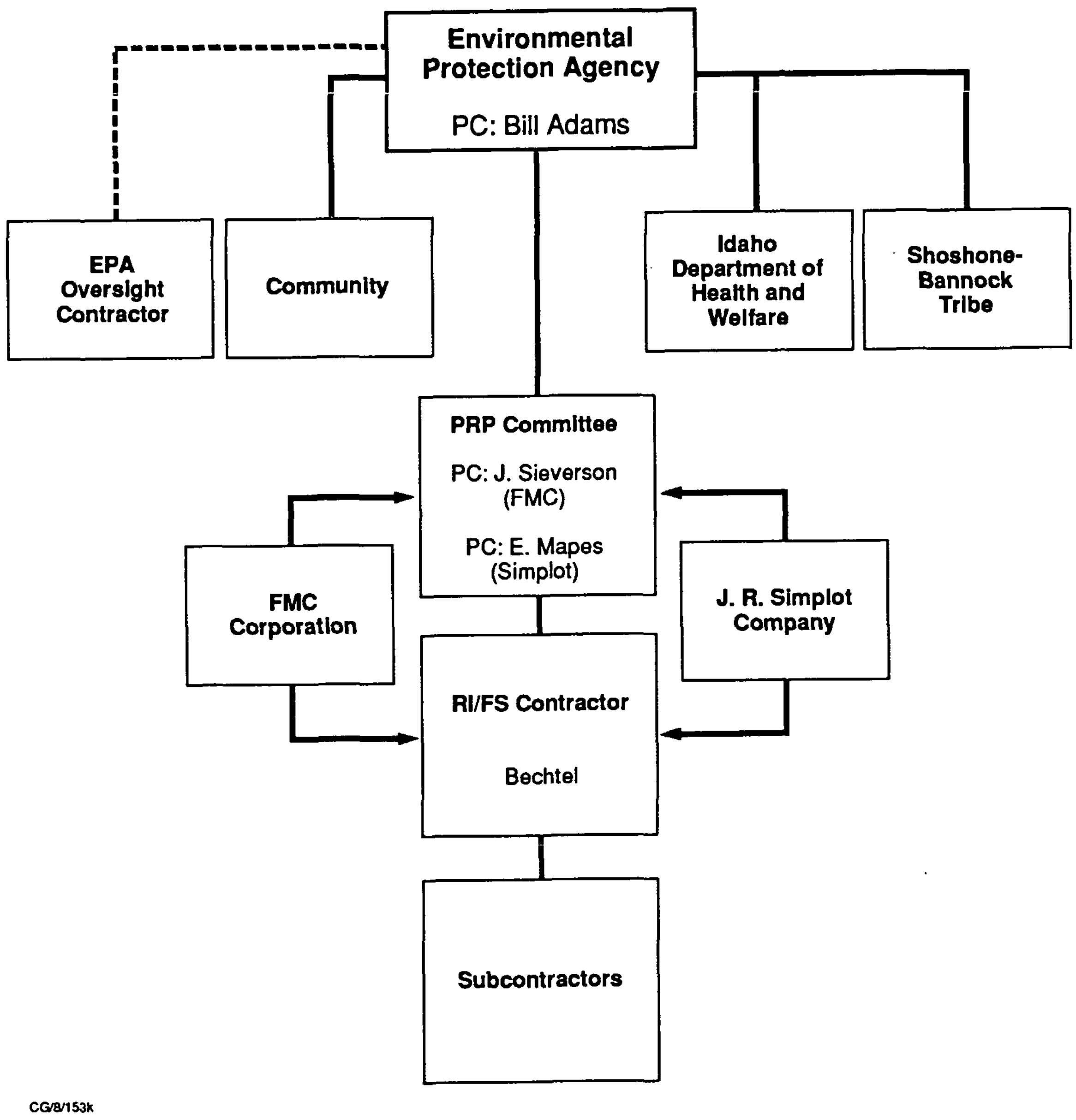

Figure 7-1 Eastern Michaud Flats RI/FS– Overall Organizational Chart

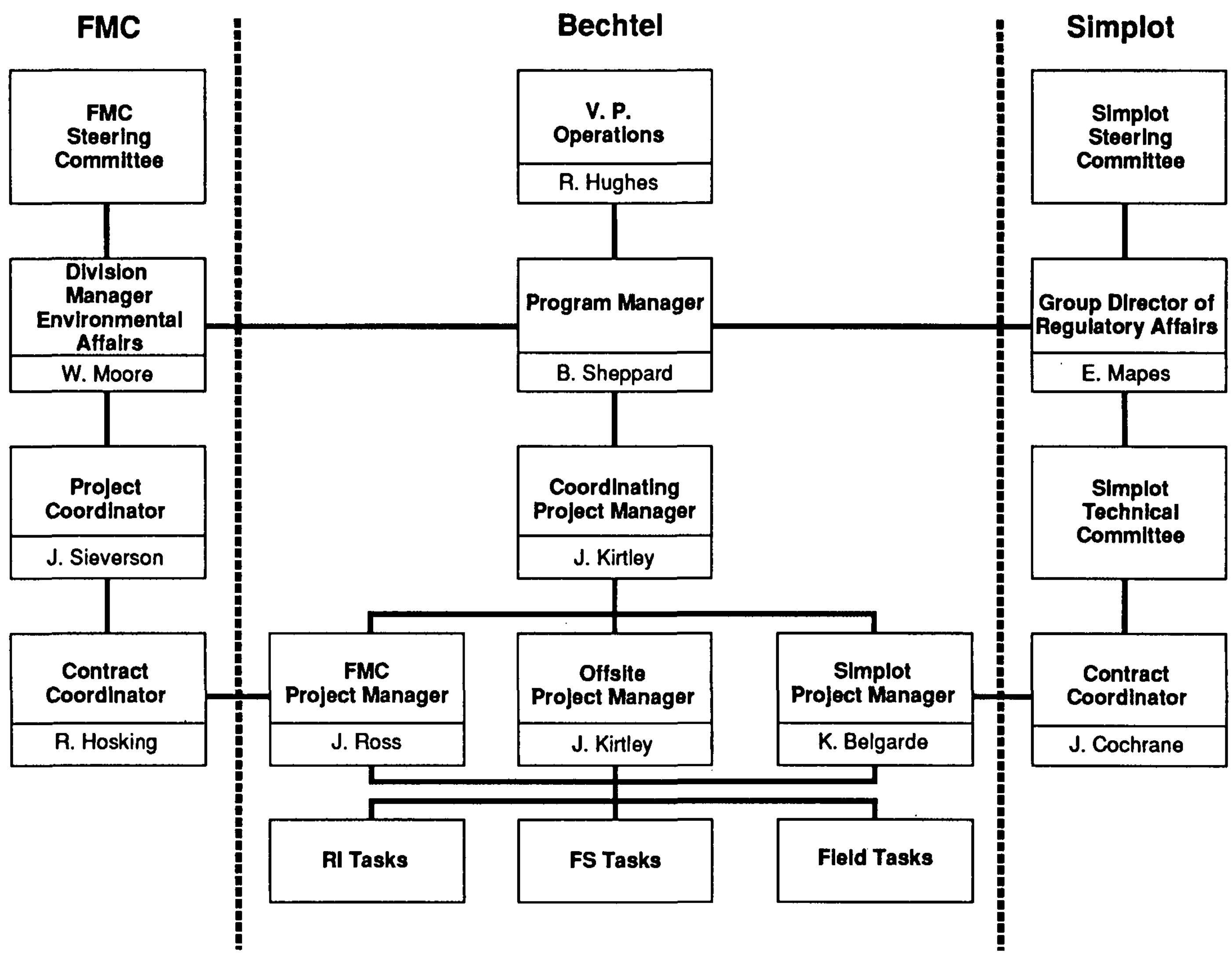

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Figure 7-2 Eastern Michaud Flats RI/FS– Project Organization Chart

7.1.2 J. R. Simplot Company

The J. R. Simplot Company is represented on the PRP Committee by Mr. Earl C. Mapes, Director of Regulatory Affairs. In addition, J. R. Simplot has a Technical Committee which acts as an interface with the project. Other key members of the J. R. Simplot team include:

Key J. R. Simplot Staff	Title/Area of Responsibility
J. F. "Jack" Cochrane	Environmental Manager – Manufacturing
Gary Long	Production Manager
Ward Wolleson	Sr. Environmental Engineer
Steve Curreri	Environmental Manager – Mining

7.1.3 Bechtel Environmental, Inc.

Mr. Barry S. Sheppard is the Bechtel Program Manager for the EMF site. He is responsible to both Respondents and to Bechtel Environmental's Vice President/ Manager of Environmental Services, Dr. Robert A. Hughes, for all aspects of the project, including administrative, financial, technical, and legal. Mr. Sheppard also provides input and continuity regarding other Superfund work being performed by BEI under his direction.

Bechtel Environmental has assigned three Project Managers (PMs) to the EMF RI/FS Project, consistent with the physical layout of the EMF site. Mr. John H. Ross is the FMC Project Manager and Ms. Kim E. Belgarde is the Simplot Project Manager. Each of these PMs maintains the direct working interface with the corresponding company's Contract Coordinator, as well as being responsible for investigation efforts within that company's facility boundary limits. The third PM, Mr. John R. Kirtley, is responsible for coordinating the joint activities of both companies in the area outside of the individual plant boundaries, and for managing activities which are inherently inseparable by Respondent. Mr. Kirtley is also responsible for coordinating the efforts of the other two PMs and thus functions in a dual role as the Coordinating PM. The BEI PMs are responsible for the day-to-day activities of the RI/FS team, including technical content and quality of AOC deliverables. The BEI PMs are also responsible for development and implementation of an ongoing project controls program, as described later in this section.

Consistent with the concept of one Superfund site and one RI/FS effort, BEI has organized the production level staff on a functional basis, without regard to individual Respondent. In this case, that functional organization consists of RI Tasks, FS Tasks, and Field Tasks. These functions are fulfilled by a variety of technical specialists who perform their respective tasks uniformly, across physical plant boundaries, and interface individually with the appropriate PM for each location.

7.1.4 Other PRP Contractors and Subcontractors

Both Respondents have and will continue to enter into additional environmental contracts directly with other companies for work related directly to the operating facilities or indirectly in support of the RI/FS tasks. For example, both companies have existing contracts in place to collect and analyze water samples taken from existing wells. It is the responsibility of the individual companies to coordinate those efforts related to the RI/FS with Bechtel and EPA, and to ensure that these contractors are following the prescribed EPA requirements and guidance, as well as QA/QC and safety procedures consistent with the RI/FS.

BEI, as prime contractor for the RI/FS, will subcontract and manage direct investigation and remedial study efforts required under the AOC. This responsibility includes subcontracts for all drilling activity, analytical services, and treatability studies required to complete the RI/FS tasks. Additional subcontract efforts may be added as project scope is further developed. Responsibility for any additional subcontracts or changes in the management of existing contracts will be negotiated between BEI and the Respondents.

7.2 RI/FS PROJECT COMMUNICATION AND INTERFACE

As discussed earlier, there is a wide range of individuals and entities which maintain responsibility for, or have a legitimate interest in, various elements of the investigation work at the EMF site. The lead agency is the United States Environmental Protection Agency (EPA), Region 10. The EPA is the agency which prepares and enforces the AOC under authority of CERCLA. Representing EPA Region 10 for the EMF RI/FS work is Mr. Bill Adams, Project Coordinator. Mr. Adams is the key EPA individual responsible for oversight of the PRP efforts, and has all of the authority lawfully vested in a Remedial Project Manager (RPM) and On-Scene Coordinator (OSC) by the NCP. Mr. Adams is also the focal point for communication of RI/FS activities and findings with all off-project entities. Further details pertaining to communication and interface are outlined below.

7.2.1 EPA Region 10

All notices and documents which must be prepared and submitted by the PRPs under the AOC shall be directed as follows. Four (4) copies shall be submitted to:

Bill Adams, M/S HW-113
U. S. EPA
1200 Sixth Avenue
Seattle, Washington 98101

One (1) copy shall be submitted to each of the following:

Mike Thomas
State of Idaho
Department of Health and Welfare
Division of Environmental Quality
1410 North Hilton
Boise, Idaho 83706

Gordon Brown
State of Idaho
Department of Health and Welfare
Division of Environmental Quality
Pocatello Field Office
224 South Arthur
Pocatello, Idaho 83204

Gary Fenwick
Shoshone Bannock Tribe
P. O. Box 306
Ft. Hall, Idaho 83202

7.2.2 PRPs (Respondents)

All notices and documents which must be prepared and submitted to the PRPs under the AOC shall be directed as follows. One (1) copy each shall be submitted to:

Earl Mapes
J. R. Simplot Company
P. O. Box 912
Pocatello, Idaho 83204

Jim Sieverson
FMC Corporation
Phosphorus Chemicals Division
P. O. Box 4111
Pocatello, Idaho 83202

7.2.3 Other Parties

EPA will coordinate with other federal and state regulatory agencies, as well as the Shoshone-Bannock Tribe, the community, and all other off-project entities. All contact and information exchange will be through the EPA Project Coordinator, Bill Adams. Exceptions will be made on a case-by-case basis as directed by EPA and agreed to by the Respondents.

7.3 AOC MONTHLY PROGRESS REPORT

In addition to the specific deliverables set forth in the AOC, the Respondents are required to provide monthly progress reports to the EPA by the tenth day of each month following the effective date of the AOC. Respondents have elected to establish a cutoff date of the 21st of each month for purposes of monthly report status. That is, progress reports submitted to the EPA by the tenth of any given month will indicate project status through the 21st of the previous month. This schedule was chosen to allow adequate time for report preparation by the RI/FS contractor plus review, comment, and coordination between the Respondents. The monthly progress reporting cycle has already been initiated, beginning with AOC Monthly Progress Report No. 1 dated June 7, 1991.

Per the AOC, monthly reports are required to provide, at a minimum: 1) a description of actions undertaken to comply with the AOC during the reporting period; 2) results of sampling, testing, and other data not previously supplied to EPA; 3) a description of work plans for the next two months including schedules and percentage completion; and 4) a description of actual or potential problems and/or delays, including plans to resolve such problems. To address these directives, the AOC Monthly Progress Report has been established to provide information on project status and upcoming project activities according to the following format:

1. Progress During Reporting Period
2. Analytical Results Received During Reporting Period
3. Other Technical Data Received/Generated During Reporting Period
4. Work Planned for Next Two Months
    A. Office Activities
    B. Field Activities
5. Status of AOC Deliverables
6. Summary of Actual/Anticipated Problems/Delays/Solutions
7. Additional Issues

8. Schedule and Deliverables

Section 8

Schedule and Deliverables

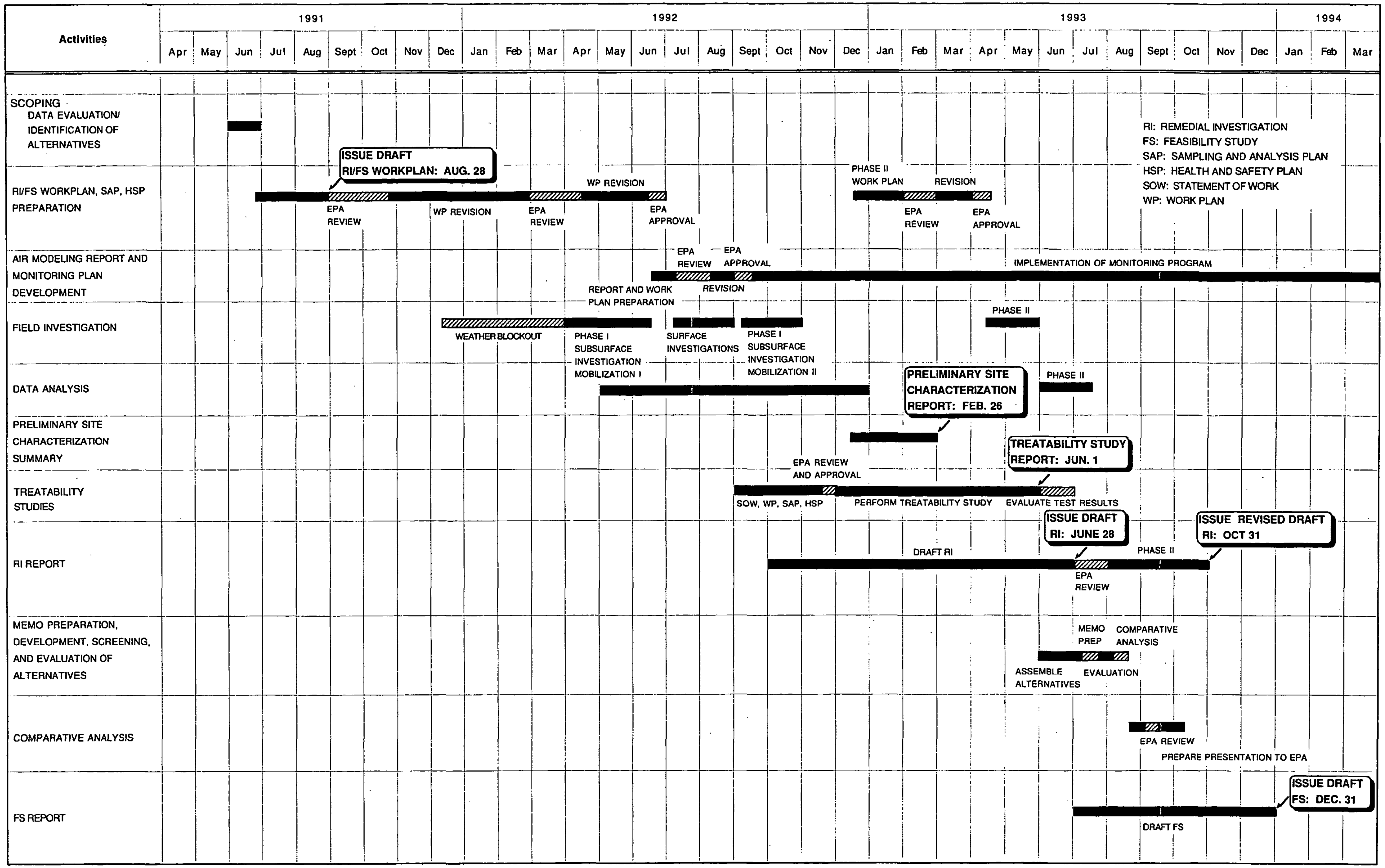
The overall RI/FS schedule was originally developed based on negotiations between the Respondents and the EPA. The key goal was that the project schedule should be consistent with EPA's desire to issue a Record of Decision (ROD) for the EMF site in June 1994. This in turn required completion of drafts for both the RI and FS reports by December 31, 1993. Other key milestones included issue of the draft RI/FS Work Plan, the Sampling and Analysis Plan, and the Health and Safety Plan by August 28, 1991 (90 days after the AOC effective date) and anticipated issuance of the Preliminary Site Characterization Report in February 1993. The overall project schedule is an evolving document that has undergone recent revisions to accommodate current scope of field invstigation efforts. Field investigation work is scheduled throughout the non-winter months of 1992 with Phase II field investigations (if needed) occurring in the spring of 1993. An overall bar chart schedule for the EMF RI/FS work is presented in Figure 8-1. Field investigation and data analysis activities indicated on the overall bar chart schedule refer primarily to geologic and subsurface soil and groundwater activities described in Sections 6.4 and 6.5. A more detailed schedule of Phase I activities is provided in Figure 8-2, which shows two Phase I periods of subsurface investigation with the surface investigations (soil, source, surface water, ecological) occurring between those two periods. Although the schedule has been revised to more properly reflect the field investigation scope and the phased approach, the overall goal of issuing draft RI and FS reports by December 31, 1993 has been maintained.

The AOC lists 16 specific deliverables that must be prepared and submitted to complete the RI/FS. A listing of these 16 AOC deliverables and the time increments allotted for their completion is provided in Table 8-1. In addition, Respondents will submit AOC Monthly Progress Reports to the EPA by the tenth day of each month, in accordance with the terms of the AOC. This schedule is predicated on scheduled EPA reviews and approvals as shown. Delays will alter the proposed schedule.

Table 8-1
AOC DELIVERABLES

AOC Deliverables	Time Increment for AOC Deliverable
Draft RI/FS Work Plan	90 days after the effective date of the Administrative Order On Consent (AOC)
Draft Sampling and Analysis Plan (SAP)	90 days after the effective date of the Administrative Order On Consent (AOC)
Draft Health and Safety Plan (HSP)	90 days after the effective date of the Administrative Order On Consent (AOC)
Technical Memorandum on Modeling of Site Characteristics	35 days after EPA notifies Respondents in writing that field data collection for modeling is appropriate
Preliminary Site Characterization Summary	56 days after final data analysis and site characterization are complete
Draft RI Report	105 days after the Preliminary Site Characterization Summary is submitted or 42 days after receipt by Respondents of EPA Risk Assessment Report, whichever is later
Identification of Candidate Technologies Memorandum	56 days after EPA approval of the RI/FS Work Plan
Treatability Testing Statement of Work	28 days after EPA notifies Respondents in writing that treatability testing shall be required
Treatability Testing Work Plan	28 days after EPA approval of Treatability Testing Statement of Work
Treatability Study Sampling and Analysis Plan	28 days after EPA notifies Respondents in writing that a separate or revised Treatability Study SAP shall be required
Treatability Study Health and Safety Plan	28 days after EPA notifies Respondents in writing that a separate or revised Treatability Study HSP shall be required
Treatability Study Evaluation Report	42 days after the completion of any treatability testing which may be required
Memorandum on Remedial Action Objectives	28 days after Respondents' receipt of EPA Risk Assessment Report or upon issue of the Preliminary Site Characterization Summary, whichever is later
Memorandum on Development and Preliminary Screening of Alternatives	42 days after issue of the Memorandum on Remedial Action Objectives
Report on Comparative Analysis of Potential Remedial Alternatives	63 days after EPA approval of the Memorandum on Development and Preliminary Screening of Alternatives
Draft FS Report	70 days after presentation to EPA on Comparative Analysis Report

Note: All days shown refer to calendar days.



June 1, 1992

Figure 8-1 Respondents' Overall RI/FS Schedule

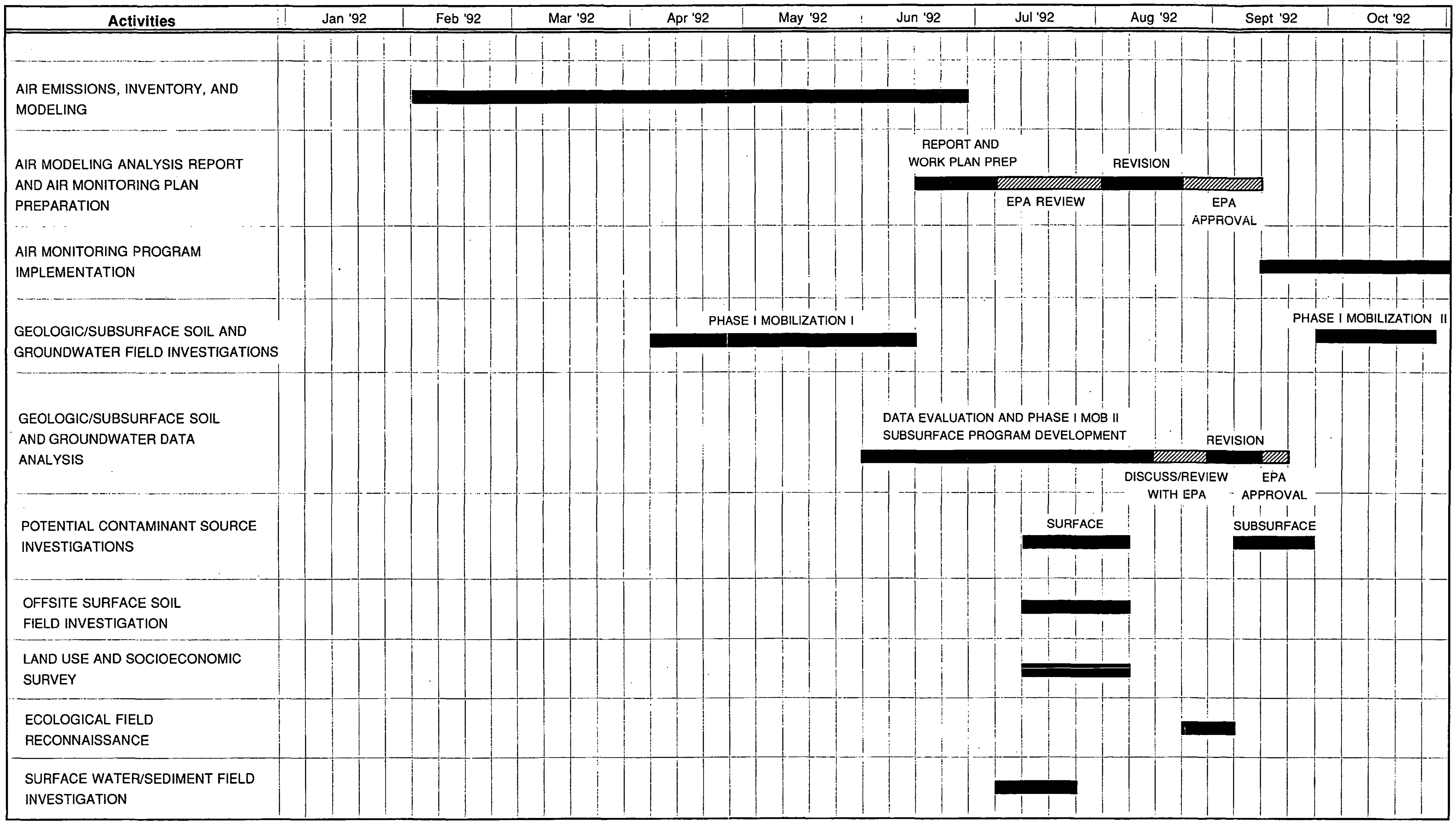


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Figure 8-2 Schedule of Phase I Activities

9. Data Management

Section 9

Data Management

This section provides a description of the data management activities to be performed as part of the RI/FS effort. A discussion of analytical data types and database file formats is included.

9.1 DATA MANAGEMENT ACTIVITIES

Data management activities for the EMF site characterization efforts include:

- Documentation of data quality and validity for field and laboratory data
- Documentation of field activities (field logs and lab reports – see Sampling and Analysis Plan)
- Establishment of a data security system to safeguard Chain-of-Custody (COC) forms and other project records to prevent loss, damage, or alteration of project documentation
- Implementation of sample management and tracking activities
- Adherence to Region 10 Groundwater Data Management Order, R10 7500.1, August 15, 1989, for all groundwater data.

Information collected during the field activities (including daily activity logs, geologic boring logs, well construction details, water level measurements, chain-of-custody manifests, and aquifer test data) will be assembled, organized, and maintained. Pertinent information obtained from daily activity logs will be entered into a computer database. (See Section 9.2.) Information obtained from the chain-of-custody manifests will be used to document the submittal of samples to the analytical laboratory. The manifests will be compared to the daily activity logs and to the geologic boring logs while in the field to ensure that consistent information is maintained and to identify any potential errors at an early stage.

9.2 DATABASE FOR ANALYTICAL AND WATER-LEVEL DATA

All sample analytical data will be tabulated, encoded, and entered into a computer database. The database will include analytical data for soil, groundwater, and surface water and sediment samples. Groundwater level data will also be tabulated, encoded, and entered into a database. All groundwater data will be entered following the procedures provided in EPA Order No. R10 7500.1, "Region 10

Groundwater Data Management" (EPA, 1989c) and incorporated into the AOC for the EMF site. Database fields will follow the format and units specified in that EPA order. The database will use dBase IV files, and will be compatible with dBase III+. Analytical data for soil, sediment and surface water will be entered into a database similar to that used for groundwater data. The analytical database will include quality assurance data.

Location and descriptive information of all sample locations and water-level measurement locations will be tabulated, encoded, and entered into a computer database. The data will be entered following the categories (fields) described in the above EPA order for Region 10 and in EPA National Order No. 2150, "Minimum Set of Data Elements for Groundwater." The Region 10 Groundwater Site Inventory (GWSI) database shell will be utilized to enter location information for groundwater data. Location information for soil and surface water data will be entered into a database similar to that for groundwater. The location database will also use dBase IV files, and will be compatible with dBase III+.

The databases described above will be presented to the EPA on diskettes.

10. References

Section 10

References

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Appendix A

Appendix A

FMC Facility Block Flow Diagrams

This appendix contains the following block flow diagrams:

Figure A-1 – Phossy Water Block Flow Diagram

Figure A-2 – Phos Dock Scrubber Blowdown Block Flow Diagram

Figure A-3 – Precipitation Slurry/Dust Block Flow Diagram

Figure A-4 – Anderson Filter Media Block Flow Diagram

Figure A-5 – Waste Solvents Block Flow Diagram

Figure A-6 – Medusa Scrubber Blowdown Block Flow Diagram

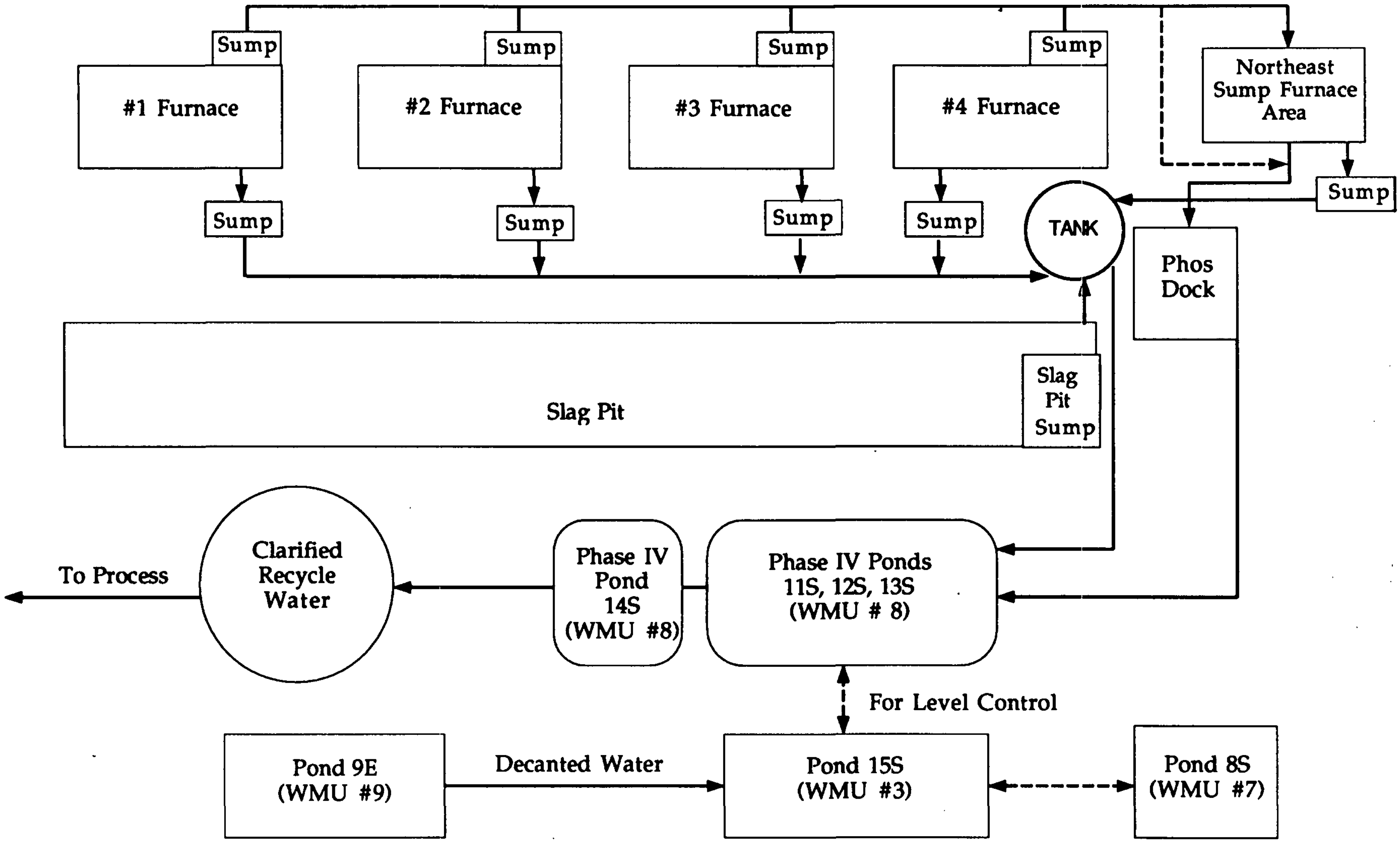

Figure A-1
Phossy Water Block Flow Diagram

Revised 1/20/92

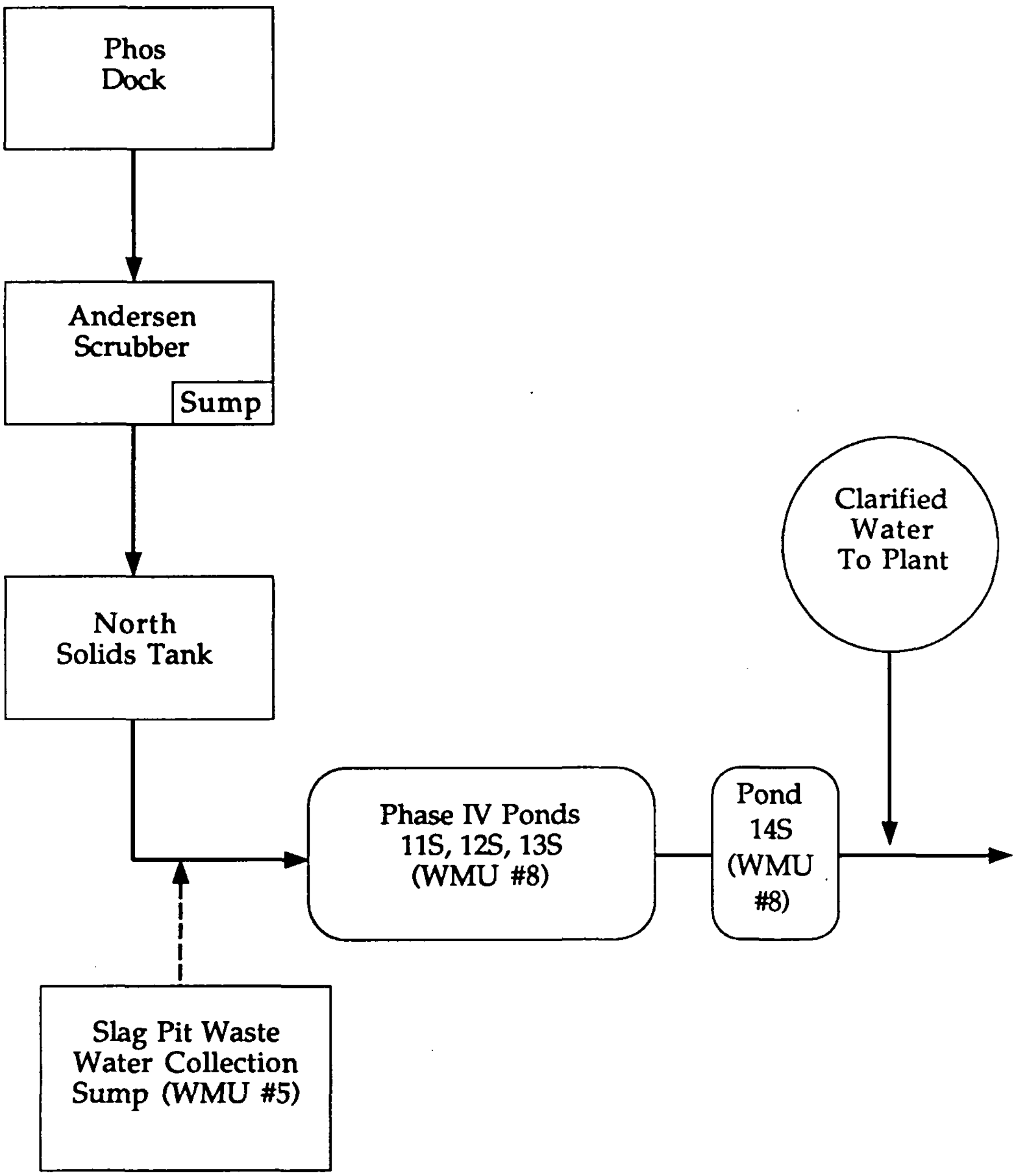

Figure A-2
Phos Dock Scrubber Blowdown Block Flow Diagram

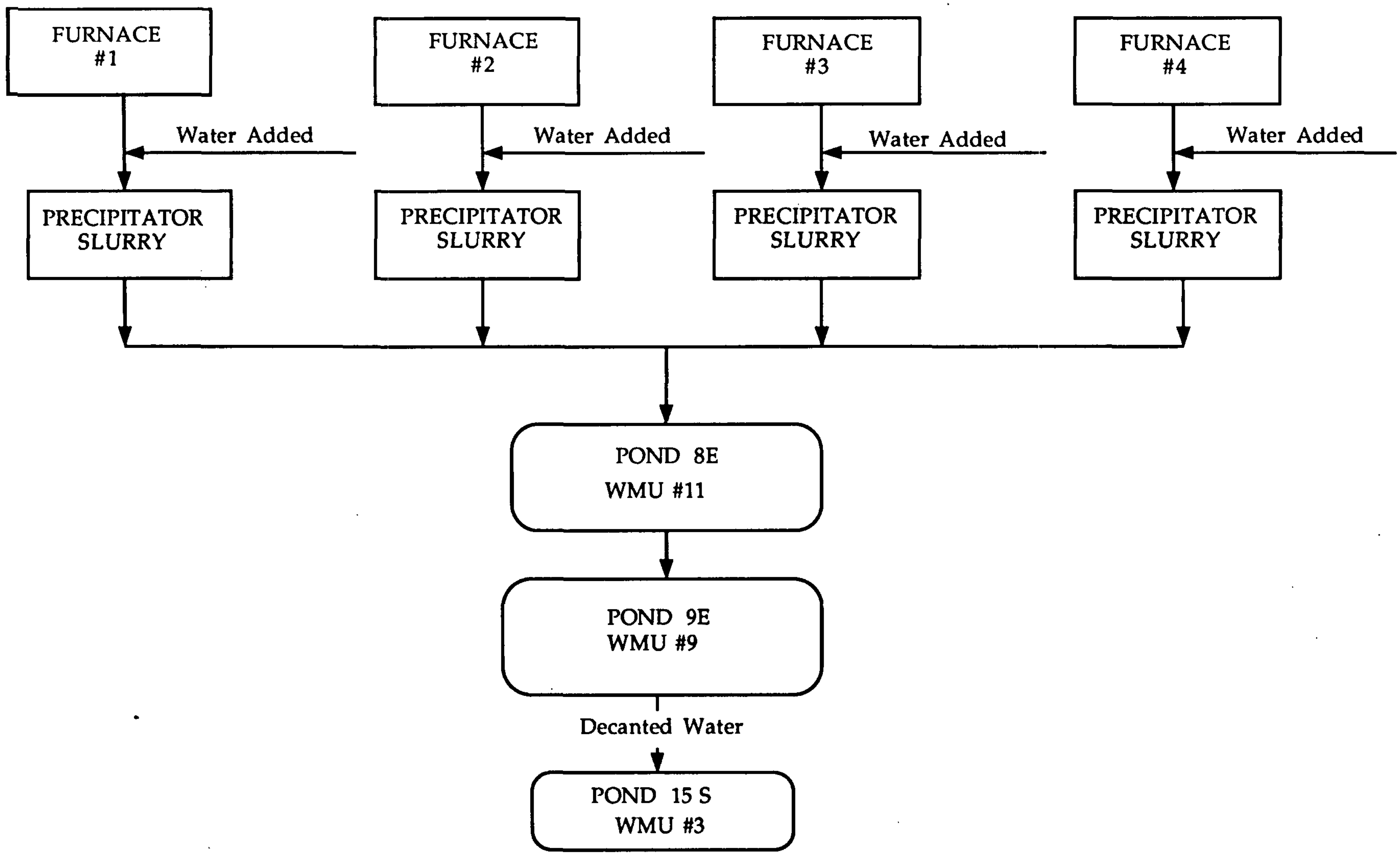

Figure A-3
Precipitator Slurry/Dust Block Flow Diagram

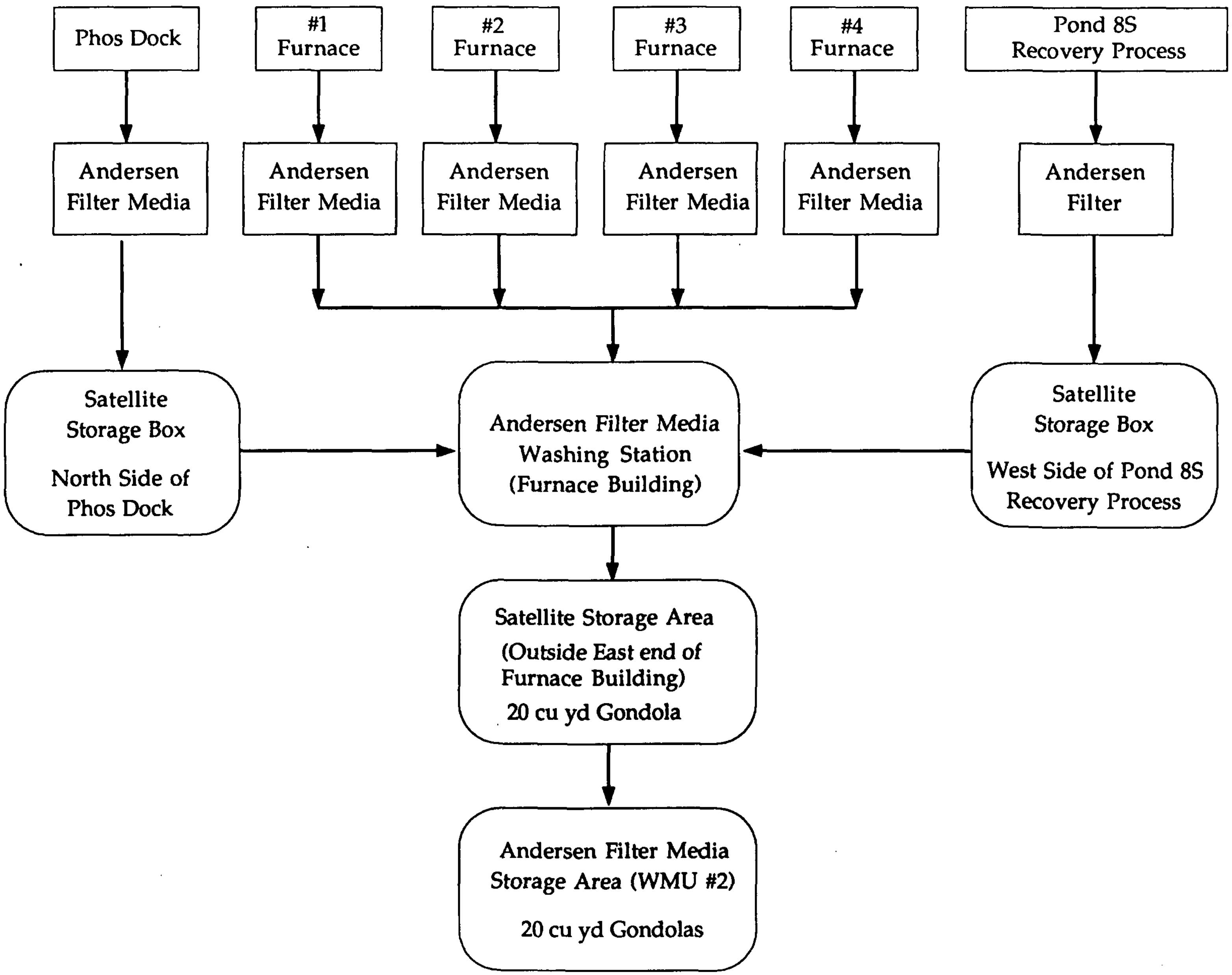

Figure A-4
Andersen Filter Media Block Flow Diagram

Revised 12/26/91

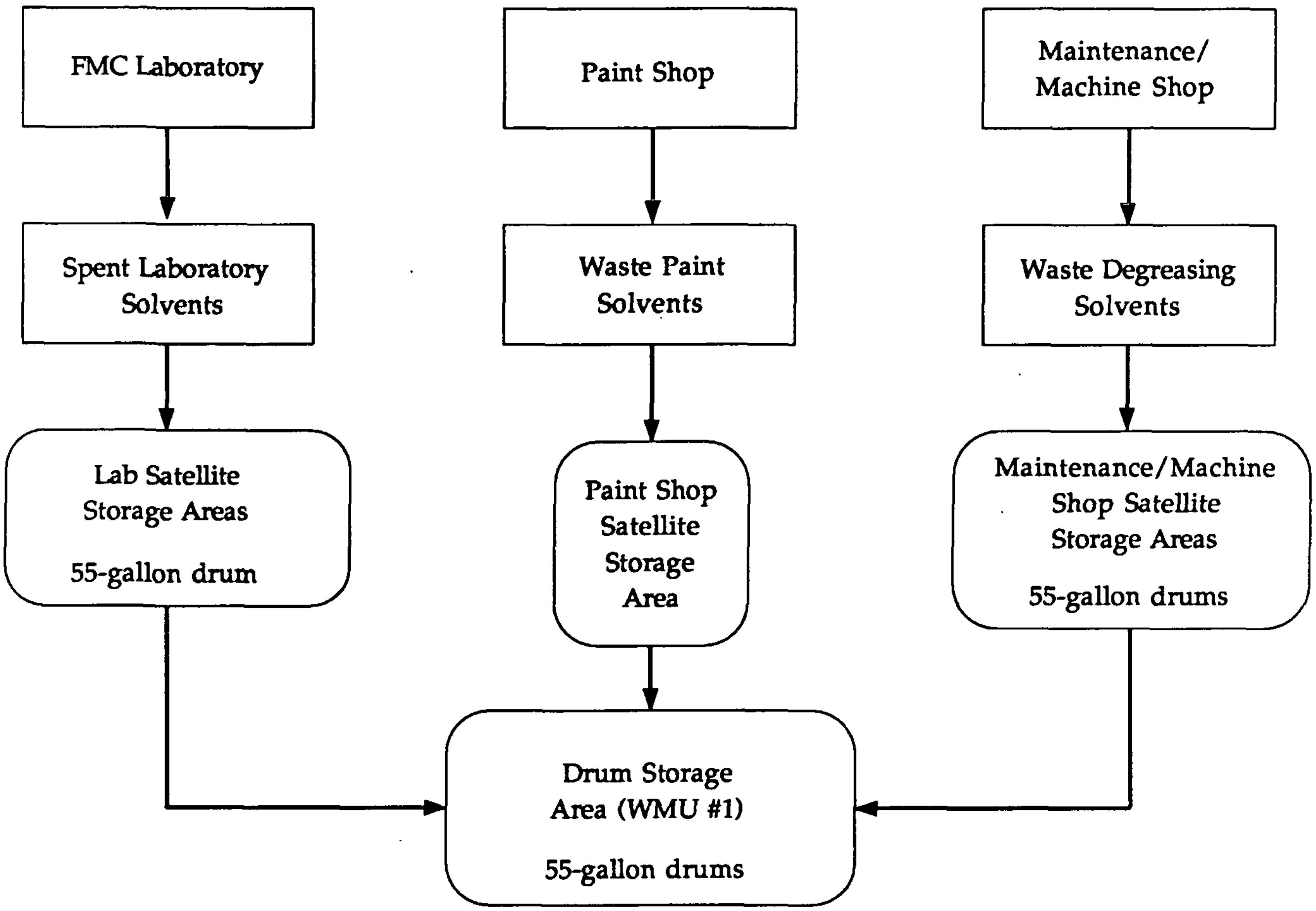

Figure A-5
Waste Solvents Block Flow Diagram

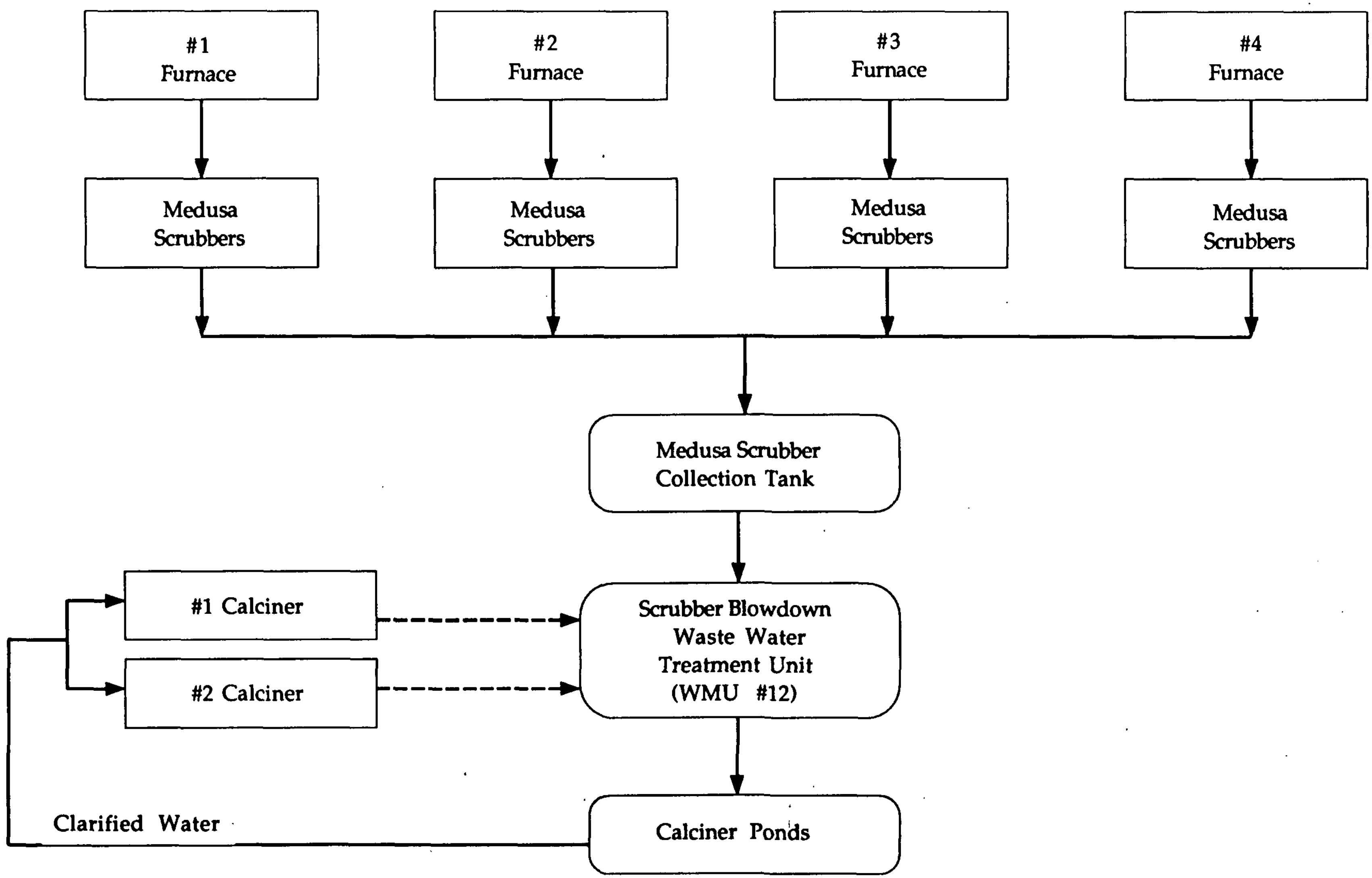

Figure A-6
Medusa Scrubber Blowdown Block Flow Diagram

Appendix B

Appendix B

Summary of Simplot Groundwater Data

Table B-1
SUMMARY OF SIMPLOT GROUNDWATER DATA – WELL PEI-1
(units in mg/l unless otherwise indicated)

Chemical name	Number of Samples in which Detected	Minimum Concentration	Maximum Concentration	Arithmetric Mean	Geometric Mean
Aluminum	9	0.005	0.49	0.100	0.046
Arsenic	12	0.003	0.006	0.005	0.005
Barium	26	0.05	0.35	0.07	0.07
Beryllium	1	0.002	0.002	0.002	0.002
Boron	23	0.02	0.45	0.08	0.06
Cadmium	4	0.001	0.01	0.004	0.003
Chromium, total	2	0.001	0.012	0.007	0.003
Cobalt	0	0	0	0	0
Copper	4	0.009	0.03	0.018	0.015
Iron	9	0.02	0.13	0.07	0.05
Lead	11	0.003	0.04	0.012	0.008
Lithium	11	0.008	0.02	0.011	0.010
Manganese	2	0.01	0.02	0.015	0.014
Mercury	2	0.0005	0.001	0.0008	0.0007
Nickel	3	0.02	0.05	0.030	0.027
Selenium	0	0	0	0	0
Silver	0	0	0	0	0
Vanadium	8	0.006	0.1	0.046	0.029
Zinc	21	0.01	0.72	0.068	0.034
Ammonia	21	0.02	0.46	0.13	0.09
Calcium	26	52.13	104	61.63	60.97
Chloride	26	27	63	40.2	39.7
Fluoride	26	0.14	0.57	0.31	0.30
Magnesium	26	3.8	19.26	13.1	12.3
Nitrate	26	0.15	2	0.77	0.69
Phosphate, total	23	0.04	0.55	0.11	0.09
Potassium	26	4.6	7.5	6.2	6.2
Sodium	26	11.5	105	19.1	15.6
Sulfate	26	6	250	32	20
Bicarbonate	26	184	222	198	198
Carbonate	0	0	0	0	0
Alkalinity, total	26	62	182	159	157
pH	26	7.1	8.55	7.7	7.7
Specific conductance, at 25 C (µmhos/cm)	26	347	880	444	434
Total dissolved solids	26	245	580	310	304
Gross alpha (pCi/L)	8	4	11	5.3	4.9
Gross beta (pCi/L)	20	4	26	9.7	8.5

Note: Well was sampled 26 times between the dates of 6/14/84 and 8/16/91

Table B-2
SUMMARY OF SIMPLOT GROUNDWATER DATA – WELL PEI-2
(units in mg/l unless otherwise indicated)

Chemical name	Number of samples in which detected	Minimum concentration	Maximum concentration	Arithmetric mean	Geometric mean
Aluminum	1	0.011	0.011	0.011	0.011
Arsenic	2	0.004	0.021	0.013	0.009
Barium	3	0.05	0.24	0.12	0.09
Beryllium	0	0	0	0	0
Boron	3	0.07	0.24	0.17	0.15
Cadmium	1	0.021	0.021	0.021	0.021
Chromium, total	2	0.01	0.01	0.010	0.010
Cobalt	0	0	0	0	0
Copper	2	0.014	0.045	0.030	0.025
Iron	2	0.01	0.1	0.06	0.03
Lead	2	0.032	0.11	0.071	0.059
Lithium	3	0.039	0.04	0.040	0.040
Manganese	3	0.02	0.03	0.023	0.023
Mercury	1	0.0007	0.0007	0.0007	0.0007
Nickel	2	0.06	0.07	0.065	0.065
Selenium	2	0.004	0.012	0.008	0.007
Silver	0	0	0	0	0
Vanadium	2	0.008	0.02	0.014	0.013
Zinc	3	0.012	0.102	0.060	0.094
Ammonia	2	0.1	0.4	0.25	0.20
Calcium	3	304	413	375.67	371.99
Chloride	3	14.9	160	64.4	35.3
Fluoride	3	0.09	0.24	0.16	0.15
Magnesium	3	113.9	121.2	116.8	116.7
Nitrate	3	0.59	3.6	2.06	1.62
Phosphate, total	3	0.11	0.56	0.28	0.22
Potassium	3	23.6	24.69	24.0	24.0
Sodium	3	124	210	153.3	148.6
Sulfate	3	780	904	825	823
Bicarbonate	3	689	932	845	838
Carbonate	0	0	0	0	0
Alkalinity, total	3	565	764	693	687
pH (pH units)	3	7.25	7.8	7.4	7.4
Specific conductance, at 25 C (μmhos/cm)	3	3200	3200	3200	3200
Total dissolved solids	3	2044	2105	2083	2083
Gross alpha (pCi/L)	3	23	48	36.3	34.7
Gross beta (pCi/L)	3	15	24	18.3	17.9

Note: Well was sampled 3 times between the dates of 6/14/84 and 6/17/85

Table B-3
SUMMARY OF SIMPLOT GROUNDWATER DATA – WELL PEI-3
(units in mg/l unless otherwise indicated)

Chemical name	Number of samples in which detected	Minimum concentration	Maximum concentration	Arithmetic mean	Geometric mean
Aluminum	6	0.01	0.238	0.103	0.072
Arsenic	24	0.004	0.472	0.198	0.126
Barium	25	0.02	0.25	0.04	0.04
Beryllium	1	0.003	0.003	0.003	0.003
Boron	24	0.1	1.154	0.52	0.49
Cadmium	9	0.002	0.028	0.010	0.007
Chromium, total	14	0.002	0.03	0.010	0.007
Cobalt	2	0.02	0.07	0.045	0.037
Copper	14	0.02	0.06	0.037	0.035
Iron	22	0.02	0.29	0.11	0.09
Lead	6	0.001	0.16	0.038	0.011
Lithium	25	0.033	0.13	0.052	0.049
Manganese	18	0.02	0.12	0.044	0.039
Mercury	1	0.001	0.001	0.0010	0.0010
Nickel	3	0.02	0.13	0.083	0.064
Selenium	9	0.002	0.022	0.005	0.004
Silver	5	0.001	0.002	0.001	0.001
Vanadium	17	0.007	0.83	0.148	0.042
Zinc	25	0.016	2.98	0.601	0.037
Ammonia	21	0.02	1.43	0.25	0.14
Calcium	25	319.95	636	488.17	480.21
Chloride	25	72.7	124	95.6	94.5
Fluoride	23	0.03	0.33	0.13	0.10
Magnesium	25	19.2	147.6	111.2	104.9
Nitrate	25	0.12	4.5	2.19	1.68
Phosphate, total	25	0.04	84.5	37.27	15.35
Potassium	25	2.58	17.1	14.0	13.5
Sodium	25	550	758.8	654.2	651.7
Sulfate	25	1835	2650	2030	2023
Bicarbonate	25	595	1549.4	978	939
Carbonate	0	0	0	0	0
Alkalinity, total	25	488	1270	801	770
pH	25	6.6	8.2	7.1	7.1
Specific conductance, at 25 C (μmhos/cm)	25	3190	6930	5552	5433
Total dissolved solids	25	3698	4550	3998	3992
Gross alpha (pCi/L)	8	4	9	6.3	6.0
Gross beta (pCi/L)	17	4	22	9.7	8.9

Note: Well was sampled 25 times between the dates of 6/14/84 and 8/16/91

Table B-4
SUMMARY OF SIMPLOT GROUNDWATER DATA - WELL PEI-4
(units in mg/l unless otherwise indicated)

Chemical name	Number of samples in which detected	Minimum concentration	Maximum concentration	Arithmetric mean	Geometric mean
Aluminum	9	0.006	0.18	0.069	0.052
Arsenic	3	0.002	0.008	0.005	0.004
Barium	25	0.06	0.22	0.13	0.13
Beryllium	0	0	0	0	0
Boron	24	0.1	0.54	0.22	0.20
Cadmium	0	0	0	0	0
Chromium, total	2	0.004	0.004	0.004	0.004
Cobalt	3	0.02	0.03	0.02	0.02
Copper	4	0.006	0.05	0.022	0.016
Iron	10	0.03	0.15	0.07	0.06
Lead	8	0.001	0.04	0.011	0.006
Lithium	25	0.02	0.05	0.034	0.034
Manganese	3	0.01	0.02	0.017	0.016
Mercury	0	0	0	0	0
Nickel	3	0.01	0.03	0.020	0.018
Selenium	1	0.002	0.002	0.002	0.002
Silver	0	0	0	0	0
Vanadium	7	0.01	0.24	0.107	0.057
Zinc	16	0.009	0.14	0.035	0.041
Ammonia	20	0.03	2	0.24	0.11
Calcium	25	20	128	85.66	82.44
Chloride	25	30	109	66.5	65.0
Fluoride	25	0.16	0.6	0.21	0.21
Magnesium	25	9.6	42	30.8	29.7
Nitrate	25	0.45	2.8	1.75	1.68
Phosphate, total	24	0.05	14.8	0.99	0.21
Potassium	25	5.1	9.5	7.1	7.0
Sodium	25	41.2	85	51.9	51.1
Sulfate	25	38	160	68	64
Bicarbonate	25	187.8	406	365	361
Carbonate	0	0	0	0	0
Alkalinity, total	25	154	333	299	296
pH	25	7.3	8.1	7.8	7.8
Specific conductance, at 25 C (µmhos/cm)	25	450	950	763	756
Total dissolved solids	25	310	620	510	507
Gross alpha (pCi/L)	6	3	25	7.2	5.0
Gross beta (pCi/L)	18	4	15	7.9	7.3

Note: Well was sampled 25 times between the dates of 6/14/84 and 8/16/91

Table B-5
SUMMARY OF SIMPLOT GROUNDWATER DATA – WELL PEI-5
(units in mg/l unless otherwise indicated)

Chemical name	Number of samples in which detected	Minimum concentration	Maximum concentration	Arithmetric mean	Geometric mean
Aluminum	21	0.002	1.81	0.266	0.150
Arsenic	7	0.002	0.024	0.009	0.006
Barium	24	0.04	0.4	0.09	0.08
Beryllium	2	0.001	0.002	0.002	0.001
Boron	23	0.02	0.47	0.10	0.08
Cadmium	4	0.002	0.008	0.004	0.004
Chromium, total	5	0.004	0.03	0.013	0.009
Cobalt	2	0.02	0.02	0.02	0.02
Copper	4	0.01	0.053	0.027	0.022
Iron	21	0.03	0.26	0.13	0.11
Lead	7	0.003	0.04	0.011	0.007
Lithium	14	0.006	0.03	0.015	0.013
Manganese	12	0.01	0.11	0.038	0.028
Mercury	2	0.0004	0.0005	0.0005	0.0004
Nickel	4	0.02	0.1	0.048	0.038
Selenium	0	0	0	0	0
Silver	0	0	0	0	0
Vanadium	6	0.005	0.42	0.149	0.052
Zinc	23	0.022	1.06	0.205	0.068
Ammonia	22	0.03	0.45	0.17	0.12
Calcium	24	47.95	270.58	80.61	72.76
Chloride	24	18.5	76	57.1	54.9
Fluoride	23	0.16	0.75	0.33	0.31
Magnesium	24	0.4	62.89	15.2	10.4
Nitrate	24	0.65	3.72	1.98	1.89
Phosphate, total	23	0.06	8.99	0.94	0.33
Potassium	24	0.93	3.22	2.3	2.2
Sodium	24	18.9	49.49	26.8	25.8
Sulfate	24	18	566	72	43
Bicarbonate	24	146.4	392	198	191
Carbonate	0	0	0	0	0
Alkalinity, total	24	64	321	158	150
pH	24	6.84	7.9	7.4	7.4
Specific conductance, at 25 C (µmhos/cm)	24	350	1630	568	526
Total dissolved solids	24	221	1356	414	371
Gross alpha (pCi/L)	9	4	12	6.4	5.9
Gross beta (pCi/L)	14	4	15	6.6	5.9

Note: Well was sampled 24 times between the dates of 6/14/84 and 8/16/91

Table B-6
SUMMARY OF SIMPLOT GROUNDWATER DATA – WELL PEI-6
(units in mg/l unless otherwise indicated)

Chemical name	Number of samples in which detected	Minimum concentration	Maximum concentration	Arithmetric mean	Geometric mean
Aluminum	11	0.01	0.196	0.070	0.051
Arsenic	4	0.002	0.004	0.003	0.003
Barium	25	0.11	0.35	0.14	0.14
Beryllium	1	0.002	0.002	0.002	0.002
Boron	25	0.02	0.49	0.20	0.17
Cadmium	1	0.007	0.007	0.007	0.007
Chromium, total	5	0.002	0.01	0.005	0.004
Cobalt	2	0.007	0.02	0.01	0.01
Copper	6	0.01	0.03	0.021	0.019
Iron	16	0.02	0.17	0.07	0.06
Lead	8	0.004	0.05	0.019	0.013
Lithium	26	0.02	0.04	0.035	0.035
Manganese	2	0.01	0.02	0.015	0.014
Mercury	1	0.0009	0.0009	0.0009	0.0009
Nickel	4	0.02	0.04	0.033	0.031
Selenium	0	0	0	0	0
Silver	0	0	0	0	0
Vanadium	10	0.002	0.24	0.075	0.025
Zinc	23	0.01	0.25	0.051	0.116
Ammonia	22	0.04	0.6	0.14	0.10
Calcium	26	72	139.2	90.98	89.56
Chloride	26	48.2	76	62.1	61.8
Fluoride	26	0.1	0.46	0.22	0.21
Magnesium	26	12.9	42.24	31.0	30.1
Nitrate	26	0.67	2.88	1.80	1.73
Phosphate, total	25	0.04	0.5	0.14	0.11
Potassium	26	5.33	7.7	6.7	6.7
Sodium	26	39.44	65	48.5	48.0
Sulfate	26	34	150	59	55
Bicarbonate	26	297	416	379	378
Carbonate	0	0	0	0	0
Alkalinity, total	26	244	341	311	310
pH	26	7.2	8.2	7.7	7.7
Specific conductance, at 25 C (µmhos/cm)	26	609	950	769	765
Total dissolved solids	26	430	620	505	503
Gross alpha (pCi/L)	5	4	12	7.6	7.1
Gross beta (pCi/L)	22	3	16	7.2	6.6

Note: Well was sampled 26 times between the dates of 6/14/84 and 8/16/91

Table B-7
SUMMARY OF SIMPLOT GROUNDWATER DATA – FRONTIER WELL
(units in mg/l unless otherwise indicated)

Chemical name	Number of samples in which detected	Minimum concentration	Maximum concentration	Arithmetric mean	Geometric mean
Aluminum	17	0.005	0.31	0.084	0.045
Arsenic	23	0.001	0.004	0.002	0.002
Barium	44	0.08	0.16	0.10	0.10
Beryllium	2	0.002	0.002	0.002	0.002
Boron	41	0.08	0.23	0.13	0.12
Cadmium	2	0.001	0.006	0.004	0.002
Chromium, total	15	0.001	0.034	0.005	0.003
Cobalt	4	0.003	0.023	0.009	0.006
Copper	22	0.005	0.055	0.016	0.013
Iron	26	0.01	0.21	0.04	0.03
Lead	11	0.002	0.015	0.005	0.004
Lithium	44	0.03	0.092	0.048	0.047
Manganese	16	0.001	0.02	0.008	0.006
Mercury	1	0.0011	0.0011	0.0011	0.0011
Nickel	6	0.02	0.082	0.049	0.044
Selenium	3	0.001	0.002	0.001	0.001
Silver	1	0.006	0.006	0.006	0.006
Vanadium	10	0.002	0.17	0.041	0.011
Zinc	33	0.002	0.095	0.033	0.046
Ammonia	29	0.05	1.35	0.22	0.15
Calcium	44	54.52	96.8	70.29	69.47
Chloride	44	24.6	75	39.8	39.2
Fluoride	44	0.28	0.73	0.59	0.58
Magnesium	44	3.1	33.6	19.5	17.5
Nitrate	42	0.21	3	1.43	1.29
Phosphate, total	42	0.02	0.78	0.16	0.11
Potassium	44	4.7	6.7	5.7	5.7
Sodium	44	32.9	63	39.6	39.3
Sulfate	44	40	230	60	57
Bicarbonate	42	233	336.7	279	278
Carbonate	0	0	0	0	0
Alkalinity, total	44	191	276	229	228
pH	44	7.1	8.3	7.8	7.8
Specific conductance, at 25 C (µmhos/cm)	44	464	980	589	585
Total dissolved solids	44	310	640	391	388
Gross alpha (pCi/L)	14	0.9	9	3.2	2.7
Gross beta (pCi/L)	32	1.1	13	5.8	4.8

Note: Well was sampled 44 times between the dates of 9/28/78 and 8/14/91

Table B-8
SUMMARY OF SIMPLOT GROUNDWATER DATA – IDAHO POWER WELL
(units in mg/l unless otherwise indicated)

Chemical name	Number of samples in which detected	Minimum concentration	Maximum concentration	Arithmetric mean	Geometric mean
Aluminum	5	0.002	0.11	0.039	0.016
Arsenic	9	0.007	0.02	0.014	0.014
Barium	11	0.03	0.068	0.05	0.05
Beryllium	0	0	0	0	0
Boron	11	0.047	0.17	0.11	0.10
Cadmium	0	0	0	0	0
Chromium, total	5	0.002	0.003	0.002	0.002
Cobalt	1	0.02	0.02	0.020	0.020
Copper	4	0.01	0.04	0.018	0.014
Iron	5	0.01	0.16	0.04	0.02
Lead	3	0.003	0.03	0.012	0.006
Lithium	10	0.012	0.02	0.015	0.015
Manganese	7	0.002	0.02	0.008	0.006
Mercury	0	0	0	0	0
Nickel	1	0.06	0.06	0.060	0.060
Selenium	3	0.002	0.003	0.002	0.002
Silver	0	0	0	0	0
Vanadium	7	0.009	0.015	0.011	0.011
Zinc	11	0.035	1.05	0.428	0.045
Ammonia	6	0.04	0.52	0.16	0.11
Calcium	11	41.6	71.6	49.51	48.89
Chloride	11	22.9	54	38.3	37.5
Fluoride	11	0.37	0.71	0.44	0.43
Magnesium	10	9.6	32.4	17.4	16.1
Nitrate	11	0.34	1.68	1.12	1.02
Phosphate, total	10	0.06	1.4	0.33	0.22
Potassium	11	6.3	8.7	7.8	7.8
Sodium	11	24.6	73	36.8	33.8
Sulfate	11	6	120	42	31
Bicarbonate	11	194	258.6	211	210
Carbonate	0	0	0	0	0
Alkalinity, total	11	159	212	173	172
pH	11	7.25	7.95	7.6	7.6
Specific conductance, at 25 C (µmhos/cm)	11	370	600	463	459
Total dissolved solids	11	241	396	309	306
Gross alpha (pCi/L)	4	4	7	5.0	4.9
Gross beta (pCi/L)	6	8	12	9.7	9.6

Note: Well was sampled 11 times between the dates of 7/20/82 and 7/27/88

Table B-9
SUMMARY OF SIMPLOT GROUNDWATER DATA – LINDLEY WELL
(units in mg/l unless otherwise indicated)

Chemical name	Number of samples in which detected	Minimum concentration	Maximum concentration	Arithmetric mean	Geometric mean
Aluminum	3	0.004	0.07	0.038	0.022
Arsenic	6	0.002	0.016	0.009	0.007
Barium	11	0.08	0.12	0.10	0.10
Beryllium	0	0	0	0	0
Boron	11	0.088	0.473	0.28	0.26
Cadmium	0	0	0	0	0
Chromium, total	6	0.003	0.01	0.005	0.004
Cobalt	4	0.003	0.005	0.004	0.003
Copper	9	0.008	0.05	0.019	0.016
Iron	7	0.01	0.21	0.05	0.03
Lead	2	0.002	0.05	0.026	0.010
Lithium	11	0.07	0.12	0.094	0.093
Manganese	7	0.002	0.02	0.010	0.008
Mercury	1	0.0005	0.0005	0.0005	0.0005
Nickel	0	0	0	0	0
Selenium	6	0.002	0.009	0.004	0.003
Silver	0	0	0	0	0
Vanadium	5	0.008	0.01	0.009	0.009
Zinc	11	0.06	0.6	0.239	0.097
Ammonia	5	0.05	0.92	0.32	0.18
Calcium	11	134.4	173.6	152.85	152.48
Chloride	11	213.1	401	316.0	310.2
Fluoride	11	0.32	0.55	0.46	0.46
Magnesium	11	34.56	67.2	52.3	51.4
Nitrate	10	1.21	7.56	5.15	4.60
Phosphate, total	10	0.05	0.34	0.15	0.13
Potassium	11	12.5	17.28	14.9	14.8
Sodium	11	129.43	280	160.6	156.6
Sulfate	11	125	355	216	206
Bicarbonate	11	264.7	641.6	358	349
Carbonate	0	0	0	0	0
Alkalinity, total	11	217	304	271	270
pH	11	7	7.7	7.3	7.3
Specific conductance, at 25 C (μmhos/cm)	11	1500	2298	1727	1713
Total dissolved solids	11	989	1494	1116	1108
Gross alpha (pCi/L)	3	13	19	16.3	16.1
Gross beta (pCi/L)	7	4	17	8.7	7.9

Note: Well was sampled 11 times between the dates of 7/21/82 and 7/29/88

Appendix C

Appendix C

Potential Applicable or Relevant and Appropriate Requirements (ARARs)

LIST OF POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
Safe Drinking Water Act	42 U.S.C. § 300f et seq. Pub. L. 93-523	Goal of the Act is to protect human health by protecting the quality of drinking water. The Act authorizes the establishment of drinking water standards.	Applies to CERCLA site discharges to public drinking water sources, including underground drinking water sources. May be relevant and appropriate to cleanup of water that may be used for drinking.
National Primary Drinking Water Standards	40 CFR Part 141	Establishes primary maximum contaminant levels (MCLs) that are health-based standards for public water systems	MCLs are relevant and appropriate for any water that is considered to be a source or potential source of drinking water. MCLs are applicable at the tap when the water is directly provided to 25 or more people or 15 or more service connections. Otherwise, MCLs are relevant and appropriate.
National Secondary Drinking Water Standards	40 CFR Part 143	Establishes secondary MCLs that are welfare-based standards for public water systems.	Secondary MCLs are not federally enforceable standards, but intended as guidelines for the States. SMCLs are not ARARs unless promulgated by States.
Maximum Contaminant Level Goals (MCLGs)	40 CFR 141, Subpart F	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects, with an adequate margin of safety.	MCLGs are not federally enforceable drinking water standards, but CERCLA §121(d) has raised MCLGs and water quality criteria (see below) to the level of potentially relevant and appropriate.
Underground Injection Control Regulations	40 CFR Parts 144-147	Provides for protection of underground sources of drinking water.	Substantive requirements may apply if groundwater is treated and reinjected.
Clean Water Act	33 U.S.C. § 1251-1376	Provides for the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters.	MCLGs may be considered when a CERCLA cleanup may require more stringent standards than the MCLs.

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LIST OF POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
Water Quality Criteria	40 CFR Part 131 Quality Criteria for Water, 1976, 1980, 1986	Federal water quality criteria are guidelines from which States determine their water quality standards. Criteria are developed for the protection of human health and aquatic life.	Applicable to direct discharges to surface waters. An indirect discharge to a POTW may be considered an off-site activity even though the conveyance system is located on-site. A POTW may require a CERCLA wastewater to meet "pretreatment" standards prior to acceptance. If a water quality standard is available for a contaminant, the standard should be used rather than the criteria.
Toxic Pollutant Effluent Standards	40 CFR Part 129	Establishes effluent standards or prohibitions for specific toxic pollutants.	Applies to specified facilities discharging into navigable waters.
National Pollutant Discharge Elimination System	40 CFR Part 122, 125	Requires permits for the discharge of pollutants from any point source into waters of the United States. The Act defines a point source as any discernable, confined or discrete conveyance...from which pollutants are or may be discharged. Effluent limitations must protect beneficial uses of water.	NPDES is not an ARAR for reinjection or discharge to a POTW.
Guidelines Establishing Test Procedures for the Analysis of Pollutants	40 CFR Part 136	Identifies EPA-approved analytical methodologies for analyzing water and wastewater.	

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LIST OF POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
National Pretreatment Standards	40 CFR Part 403	Sets standards to control pollutants which pass through or interfere with treatment processes in publicly-owned treatment works (POTW) or which may contaminate sewage sludge. Standards are set by the POTW.	
Clean Air Act	42 U.S.C. §§ 7401 et seq.	Regulates emissions to protect human health and the environment. Enabling statute for major provisions such as National Ambient Air Quality Standards, NESHAPS, and NSPS.	
National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Establishes National Ambient Air Quality Standards (NAAQS) for the protection of public health and welfare.	Primary standards applicable for any remedial alternative emitting regulated pollutants.
National Emission Standards for Hazardous Air Pollutants (NESHAPS)	40 CFR Part 61	Sets emission standards, monitoring, and testing requirements for radionuclides, mercury, beryllium, asbestos, inorganic arsenic, and benzene. Standards only apply to specifically named sources in the regulations.	

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LIST OF POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
New Source Performance Standards (NSPS)	40 CFR Part 60	Sets emission standards for new and modified sources. The standards reflect the degree of emission reduction achievable through demonstrated best technology, considering costs and a number of other factors.	
Resource Conservation and and Recovery Act	42 U.S.C. §§ 6901-6987		
Criteria for Classification of Solid Waste Disposal Facilities and Practices	40 CFR Part 257	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment and thereby constitute prohibited open dumps.	The current focus of RCRA Subtitle D is primarily on municipal landfills.
Hazardous Waste Management Systems General	40 CFR Part 260	Provides definitions of hazardous waste terms, procedures for rule-making petitions, and procedures for delisting a waste.	May be applicable if variances or delisting are required.
Identification and Listing of Hazardous Waste	40 CFR Part 261	Defines those solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 261-265 and Parts 124, 270, 271.	
Standards Applicable to Generators of Hazardous Waste	40 CFR Part 262	Establishes standards for generators of hazardous waste.	Applicable if the selected remedial alternative involves generation and off-site transport of hazardous wastes.

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LIST OF POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
Standards Applicable to Transporters of Hazardous Waste	40 CFR Part 263	Establishes standards which apply to persons transporting hazardous waste within the U.S. or if the transportation requires a manifest under 40 CFR Part 262.	Applicable if the selected remedial alternatives involves off-site transportation of hazardous waste.
Standards for Owners and Operators of Hazardous Waste Treatment. Storage, and Disposal Facilities	40 CFR Part 264	Establishes minimum national standards which define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose of hazardous waste.	Generally applicable for any remedy that involves current treatment, storage or disposal. If the action does not involve current treatment, storage or disposal, it may be relevant and appropriate.
• General Facility Standards	40 CFR 264.10, Subpart B		
• Preparedness and Prevention	40 CFR 264.30, Subpart C		
• Contingency Plan and Emergency Procedures	40 CFR 264.50, Subpart D		
• Manifest System, Recordkeeping, and Reporting	40 CFR 264.70, Subpart E		
• Releases from Solid Waste Management Units	40 CFR 264.90, Subpart F		
• Closure and Post-Closure	40 CFR 264.110, Subpart G		

APPENDIX C

LIST OF POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
• Financial Requirements Subpart H	40 CFR 264.140		
• Use and Management of Containers	40 CFR 264.170, Subpart I		
• Tank Systems	40 CFR 264.190, Subpart J		
• Surface Impoundments	40 CFR 264.220, Subpart K		
• Waste Piles	40 CFR 264.250, Subpart L		
• Land Treatment	40 CFR 264.270, Subpart M		
• Landfills	40 CFR 264.300, Subpart N		
Releases from Solid Waste Management Units	40 CFR Part 264 Subpart F	Establishes maximum contaminant concentrations for groundwater protection. Concentration limits apply to the uppermost aquifer underlying the site.	The maximum contaminant concentrations that can be released from hazardous waste units are identical to the MCLs.
Interim Status TSD Facility Standards - Closure and Post-Closure	40 CFR Part 265, Subpart G	Establishes closure performance standards and post-closure care requirements.	

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LIST OF POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
Standards for the Management of Specific Hazardous Waste and Specific Types of Hazardous Waste Management Facilities	40 CFR Part 266	Establishes requirements which apply to recyclable materials that are reclaimed to recover economically significant amounts of precious metals, including gold and silver.	
Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities	40 CFR Part 267	Establishes minimum national standards that define acceptable management of hazardous waste for new land disposal facilities.	If the selected remedial alternative involves use of a new land disposal facility, 40 CFR Part 264 standards would be applicable.
Land Disposal Restrictions	40 CFR Part 268	Restricts the land disposal of hazardous waste and specifies treatment standards that must be met before these wastes can be land disposed.	Applicable if the selected remedial alternative involves placement of waste from outside the area of contamination; if waste is removed, treated and redeposited into the same or another unit. A treatability variance may also be applicable.
Hazardous Waste Permit Program	40 CFR Part 270	Establishes provisions covering basic EPA permitting requirements.	Permits are not required for on-site CERCLA response actions. Substantive requirements of 40 CFR 264 may be applicable.
Underground Storage Tanks	40 CFR Part 280	Establishes regulations related to underground storage tanks.	
Occupational Safety and Health Act	29 U.S.C. §§ 651-678	Regulates worker health and safety.	Applies to all response activities under the NCP.

APPENDIX C

LIST OF POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
Atomic Energy Act			
Licensing Requirements for Land Disposal of Radioactive Waste	10 CFR PART 61.41	Estalishes concentrations of radioactive material which may be released to the general environment in groundwater, surface water, air, soil, plants, or animals, for the protection of the general population.	
Hazardous Material Transportation Act	49 U.S.C. §§ 1801-1813		
Hazardous Materials Transportation Regulations	49 CFR Parts 107, 171-177	Regulates transportation of hazardous materials.	Applicable if waste is shipped off-site.
National Historic Preservation Act	16 U.S.C. § 470 40 CFR § 6.301(b) 36 CFR Part 800	Requires federal agencies to take into account the effect of any Federally-assisted undertaking or licensing on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places.	
Archaeological and Historic Preservation Act	16 U.S.C. § 469 40 CFR § 6.301(c)	Establishes procedures to provide for preservation of historical and archaeological data which might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	

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LIST OF POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
Historic Sites, Buildings, Objects and Antiquities	16 U.S.C. §§ 461-467 40 CFR § 6.301(a)	Requires federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on such landmarks.	
Protection and Conservation of Wildlife-Game, Fur-Bearing Animals, and Fish	16 U.S.C. §§ 661-667	Requires consultation when Federal department or agency proposes or authorizes any modification of any stream or other water body and adequate provision for protection of fish and wildlife resources.	
Endangered Species Act	16 U.S.C. 1531-1536 50 CFR Part 402	Requires action to conserve endangered species within critical habitats upon which endangered species depend, includes consultation with Department of Interior.	
Rivers and Harbors Act			
Protection of Navigable Waters and of Harbor and River Improvements	33 U.S.C. § 403		
Federal Water Pollution Control Act	33 U.S.C. §§ 1251-1376		
Dredge or Fill Requirements (Section 404)	40 CFR Parts 230, 231	Requires permits for discharge of dredged or fill material into navigable waters.	

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LIST OF POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
General Regulatory Policies - Department of the Army Corps of Engineers	33 CFR Parts 320-330	Requires permit for structures or work in or affecting navigable waters.	
Executive Order, Protection of Wetlands	Exec. Order 11990 40 CFR § 6.302(a) and Appendix A	Requires Federal agencies to avoid to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practical alternative exists.	
Executive Order, Floodplain Management	Exec. Order 11988	Requires Federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid the adverse impacts associated with direct and indirect development of a floodplain.	
<u>Wilderness Act</u>	16 U.S.C. § 1131		
National Wilderness Preservation System	50 CFR § 35.1	Establishes the national system of wilderness areas including a policy for protecting and managing these areas. It prohibits certain activities within wilderness areas.	
<u>Wild and Scenic Rivers Act</u>	16 U.S.C. § 1271 40 CFR § 6.302(e)	Prohibits adverse effects on scenic river.	

APPENDIX C

OTHER FEDERAL CRITERIA, ADVISORIES, AND GUIDANCE TO BE CONSIDERED

Statute or Regulation	Citation	Description	Comment
Migratory Bird Treaty Act	16 U.S.C. § 703-711	Prohibits killing, capturing, or transporting Golden or Bald eagles or any migratory birds, their nests and eggs. Project activities must avoid harm to migratory birds, bald and golden eagles, and their nests and eggs. Consultation with the U.S. Fish and Wild Life Service is required.	
National Secondary Drinking Water	40 CFR Part 143	Secondary maximum contaminant levels (SMCLs). Standard to control chemicals in drinking water that primarily affects the aesthetic qualities relating to public acceptance of drinking water/	Secondary standards are not federally enforceable.
National Maximum Contaminant Level Goals	Pub. L. 99-339, 100 Stat. 642 (1986)	Establishes drinking water quality goals (MCLGs), at levels of no known or anticipated adverse health effects with an adequate margin of safety. MCLGs do not take cost or feasibility into account. Under SDWA, MCLGs are goals not enforceable standards.	EPA considers MCLs first. If MCLs do not exist, MCLGs are considered. Section 121 (d)(2)(A) of CERCLA requires a level or standard of control which at least attains MCLGs established under the SDWA. EPA has determined that the use of MCLGs will be determined on a case by case basis.
Water Quality Standards	40 CFR Part 131	Nonenforceable criteria for water quality to protect human health and aquatic life. From the water quality criteria, states adopt water quality standards that protect a designated use. A water quality standard defines the water quality goals of a water body through use of designations and criteria to protect the designated uses.	CERCLA requires that the remedy selected must require a level or standard of control which at least attains water quality criteria established under Section 304 or 303 of the Clean Water Act. CERCLA also states "in determining whether or not any water quality criteria...is relevant and appropriate...the President shall consider the designated or potential use of the surface or ground water, the environmental media affected, the purposes for which the criteria were developed, and the latest information available."

APPENDIX C

LIST OF POTENTIAL STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS
EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
Media Cleanup Standards (MCS)	Proposed 55 FR pp. 30798	MCSs are established at concentrations that ensure protection of human health and the environment. Standards are set for each medium during the remedy selection process.	The regulations are proposed and therefore TBCs. When promulgated, the standards are potential ARARs. 40 CFR Part 264 Sec. 264.525.
Idaho Environmental Protection and Health Act	IC, Title 39 Health and Safety, Chapter 1	Maintain the ground water quality and satisfy existing and projected future beneficial uses, with the intention to prevent contamination of ground water to the maximum extent practical.	
Idaho Water Pollution Control Law	IC, Title 39 Chapter 36 Water Pollution Abatement	Acts to prevent and control water pollution, support and aid research, and provide financial and technical assistance to municipalities, and other agencies.	
Idaho Wastewater-Land Application Permit Regulations	Idaho DH&W, Rules and Regulations, Title 1, Chapter 17	Provides for the issuance of pollution source permits and review of plans and specifications for waste treatment facilities.	
Idaho Regulations for Public Drinking Water Systems	Idaho DH&W, Title 1, Chapter 8	Controls and regulates the design, construction, operation, maintenance, and quality control of public drinking water systems.	
Water Quality Standards and Wastewater Treatment Requirements	Idaho DH&W, Title 1, Chapter 2	These rules designate water uses, place restrictions on the discharge of wastewaters, place restrictions on human activities adversely affecting water quality, and recognize unique and outstanding waters.	Under Revision
Idaho Solid Waste Law	IC, Title 31, Chapter 44	Establishes county solid waste disposal systems.	

APPENDIX C

LIST OF POTENTIAL STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
Hazardous Waste Management Act of 1983	IC, Title 39 Chapter 44	Establishes a program to track and control hazardous wastes from generation through transportation, treatment, storage and disposal.	Idaho has been authorized by EPA to conduct their Hazardous Waste Program in lieu of the Federal Program.
State Hazardous Waste Facility Siting Act	IC, Title 39 Chapter 58	Establishes method for siting hazardous waste disposal facilities, the development of alternative methods for the treatment of hazardous waste for source reduction and disposal, and a permit system for hazardous waste facilities.	
Idaho Petroleum Clean Water Trust Fund Act	IC, Title 41 Chapter 49	Provides for a liability insurance trust fund for corrective and cleanup measures against petroleum tank leaks and other releases.	
Idaho Solid Waste Management Regulations	Idaho DH&W, Title 1, Chapter 6	Establishes solid waste management site operation standards, and regs for storage, collection, transfer, transport, processing, separation, incineration, composting, treatment, reuse, recycling, or disposal of solid wastes.	Interim status standards have been drafted but have not been released for review.
Rules, Regulations and Standards for Hazardous Waste	Idaho DH&W Title 1, Chapter 5	Implementing Regulations of the Hazardous Waste Management Act of 1983.	
Idaho Air Pollution Control Regulations	Idaho DH&W, Rules & Regulations for the Control of Air Pollution	Provides for implementation, maintenance, and enforcement of national ambient air quality standards to comply with Section 109 of the Clean Air Act.	

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LIST OF POTENTIAL STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, CRITERIA, OR LIMITATIONS
EASTERN MICHAUD FLATS SITE

Statute or Regulation	Citation	Description	Comment
Sho-Ban Groundwater Protection Act			Proposed
Groundwater Council Report to Idaho State Legislature			In preparation.

Appendix D

Appendix D

Slag and Ferrophos Data

ANALYTICA
INCORPORATED

ANALYTICAL RESULTS

FOR

FMC CORPORATION

Client ID: Slag #6
Analytica ID: 11774-6

EP-Toxicity		Concentration	
Arsenic	mg/L	ND	(0.5)
Barium	mg/L	0.3	(0.1)
Cadmium	mg/L	ND	(0.05)
Chromium	mg/L	ND	(0.1)
Lead	mg/L	ND	(0.25)
Mercury	mg/L	ND	(0.002)
Selenium	mg/L	ND	(0.5)
Silver	mg/L	ND	(0.05)

Inorganic Parameters		
Corrosivity, pH	Units	7.2
Ignitability	Degrees F	No Flash to 200

ANALYTICA
INCORPORATED

ANALYTICAL RESULTS

FOR

FMC CORPORATION

Client ID: Slag #7
Analytica ID: 11774-7

EP-Toxicity		Concentration	
Arsenic	mg/L	ND	(0.5)
Barium	mg/L	0.2	(0.1)
Cadmium	mg/L	ND	(0.05)
Chromium	mg/L	ND	(0.1)
Lead	mg/L	ND	(0.25)
Mercury	mg/L	ND	(0.002)
Selenium	mg/L	ND	(0.5)
Silver	mg/L	ND	(0.05)

Inorganic Parameters		
Corrosivity, pH	Units	7.5
Ignitability	Degrees F	No Flash to 200

ANALYTICA
INCORPORATED

ANALYTICAL RESULTS

FOR

FMC CORPORATION

Client ID: Crushed Ferrophos #8
Analytica ID: 11774-8

EP-Toxicity		Concentration	
Arsenic	mg/L	ND	(0.1)
Barium	mg/L	0.02	(0.02)
Cadmium	mg/L	ND	(0.01)
Chromium	mg/L	ND	(0.02)
Lead	mg/L	ND	(0.05)
Mercury	mg/L	ND	(0.002)
Selenium	mg/L	ND	(0.1)
Silver	mg/L	ND	(0.01)

Inorganic Parameters

Corrosivity, pH	Units	8.0
Ignitability	Degrees F	No Flash to 200

ND = Not Detected
Detection Limits in Parentheses

ANALYTICA
INCORPORATED

ANALYTICAL RESULTS

FOR

FMC CORPORATION

Client ID: Crushed Ferrophos #9
Analytica ID: 11774-9

EP-Toxicity		Concentration	
Arsenic	mg/L	ND	(0.1)
Barium	mg/L	0.05	(0.02)
Cadmium	mg/L	ND	(0.01)
Chromium	mg/L	ND	(0.02)
Lead	mg/L	ND	(0.05)
Mercury	mg/L	ND	(0.002)
Selenium	mg/L	ND	(0.1)
Silver	mg/L	ND	(0.01)

Inorganic Parameters		
Corrosivity, pH	Units	5.4
Ignitability	Degrees F	No Flash to 200

ND = Not Detected
Detection Limits in Parentheses

Appendix E

Appendix E

Methods of Statistical Analysis

STATISTICAL METHODS

Groundwater quality data from the wells will be evaluated with statistical methods. Statistical tests will be conducted for gross alpha and gross beta in each well. The statistical tests chosen will be conducted separately for each hazardous constituent in each well. The statistical method selected will be appropriate for the distribution of the data. The selection of the appropriate method will be based upon several factors including: data distribution, number of samples, and relative acceptable level of error. If the distributions of the constituents differ, more than one statistical method may be used. In addition, the tests will include provisions for the control or correction of seasonal and spatial variability as well as temporal correlation in the data.

The groundwater quality data base at the site is still being developed; therefore, it is inappropriate to select a statistical method at this time. Upon completion of quarterly monitoring for one year, FMC and Simplot will select a recommended method. Rather than focusing on a specific method, the following sections include discussions of possible applicable statistical tests for the identification of trends in groundwater quality over time.

TESTS OF DATA DISTRIBUTION

Prior to the selection and application of statistical tests to identify evidence of contamination, it is necessary to determine the distribution of the data. Many common statistical tests are based upon the assumption that the universe from which the sample was drawn was normally distributed. When samples have a normal distribution, parametric tests have a lower occurrence of Type I error (rejecting the null hypothesis of equal means when it is, in fact, true) and are thus more sensitive than non-parametric tests, at any given level of significance. In contrast, when the data are not normally distributed, nonparametric (distribution-free tests) are preferred over parametric tests, as the latter have a higher probability of Type II error (accepting a false null hypothesis). It is therefore important to test the assumption of normality prior to the application of statistical difference tests.

There are several common statistical methods available for testing data for normality. The simplest and one of the most common, prior to the widespread use of microcomputer statistical software, is the use of normal probability paper. Another simple test is to determine the skewness of the data, with highly skewed data indicative of a non-normal distribution. Additional tests available on many statistical software packages include methods to calculate normal scores ("NSCORES on Mnitab and "PROCRANK" within SAS, for example). Normal scores testing can be described as a transformation of the sample values into standard normal distribution values divided by the mean. The actual sample values are then are regressed (linear regression) against the normal scores of the data. The correlation of the normal scores with the sample values is then calculated. The correlation coefficient (r^2) is a measure of the closeness of the relationship between two variables (in this case, the data values and the calculated normal scores)--more exactly the closeness of the linear relationship. The correlation coefficient can be described approximately as the estimated proportion of the variance of Y that can be attributed to its linear regression on X while ($1-r^2$) is the proportion free from X. Thus, at r=0.9 (r^2=0.81), about 80% of the variation in Y can be attributed to its linear regression on X. In other words, 20% of the variation in Y cannot be explained by the regression on X.(Snedecor and Cochran, 1980) For the groundwater sample data, large values of the square of the correlation coefficient (r2) would indicate that the regression was statistically significant and thus, the data distribution closely followed a normal distribution.

PARAMETRIC TESTS

Parametric statistical tests will be used when data closely fit a normal distribution. Two additional data limitations to these tests are that the data must be independent and have constant variances. Common parametric tests include: student's t-test, one- and two-way analysis of variance, and linear regression correlation analysis. When data are not normally distributed, as is the case for many environmental samples which are typically log-normally distributed, (Montgomery et al., 1987; Berthouex and Hunter, 1981) nonparametric tests are used. Both types of tests have strengths and weaknesses which are dependent upon how closely the data fit or deviate form a normal distribution.

The most commonly applied parametric statistical tests are discussed in the following subsections.

Student's T-Test

The student's *t*-distribution can be used to develop confidence intervals about mean values as well as test for differences between pairs of data when the data fit a normal distribution.

The test can be applied to determine if water quality at a given well is statistically different than water quality at another well. Samples should be collected in a manner to provide at the minimum, replicates of each parameter of interest from each well location.

Analysis of Variance

Several methods exist for testing for statistically significant differences between different groups or treatments (i.e., differences in concentration over time or between locations). The most common parametric method for is the application of Analysis of Variance (ANOVA). The ANOVA test can be used to identify differences between means when two or more treatments or conditions (e.g., sample collection locations or sample collection dates) are specified.

One-Way Anova

ANOVA is used when simple pairwise comparative analysis techniques (such as a paired *t*-test) are inappropriate due to the complexity of the data set (i.e., for comparisons between two or more groups or treatments). The null hypothesis of equal means is tested in ANOVA through the application of the F-test. The appropriate F-statistic is computed based upon the specified level of Type I error (an error).

In the application of one-way ANOVA, random samples drawn from different populations are divided into different groups or treatments based upon specific experimental conditions. The ANOVA test is then performed using the means and variances calculated from each treatment. The test is commonly used to identify differences between means when more than two treatments or conditions are specified, with an independent variable held fixed. For example, one-way ANOVA can be used to determine whether groundwater (i.e., the concentrations of individual ions or contaminants, the fixed variables) varies between several different test wells (for samples collected on the same date). When statistical differences are found (as indicated by an F-statistic which exceeds the critical F-statitistic) differences between the means can be tested using any one of several common multiple comparison techniques. Type I error for multiple comparisons will be set at no less than a=0.05 for each experiment wide test period and at no less than a=0.01 for individual well comparisons.

Multiple comparison techniques include Q-method tests, Fisher's Least Significant Difference technique, Scheffe's S method, Tukey's W procedure, or the Student-Newman-Keuls procedure (Snedecor and Cochran, 1980; Ott, 1988). These procedures can be rapidly performed by most microcomputer statistical packages. The selection of the most appropriate method is not rigid because each procedure has certain advantages and disadvantages which can affect the results. For this reason, most statistical software packages are structured to provide comparisons using several of these methods, thereby providing a more rigorous base to the conclusions which will be made.

Two-Way Anova

Two-way ANOVA is used (as opposed to one-way ANOVA tests) when two discrete, independent variables are involved; for example, well location and sampling date. The test can be used to define differences in the mean of a sample set collected as a function of these two independent variables. The application of the test is similar to that described for one-way ANOVA.

NON-PARAMETRIC TESTS

In many situations, parametric tests can be less powerful than their nonparametric alternatives. Considering this, and the fact that there is initially (at the start of a long-term monitoring program) often an inadequate data set size available to accurately test for the normality of the population, nonparametric tests have been recommended for analysis of trends in water quality data (Berryman et al., 1988; Lettenmaire, 1976; Hirsch et al., 1982). In fact, the use of nonparametric tests is advisable whenever the normality of the population's distribution is in doubt (Conover, 1971; Marascuilo and McSweeney, 1977).

Mann-Whitney or Wilcoxon Rank Sum Test

The Mann-Whitney test (Wilcoxon Rank sum test) represents a non-parametric alternative to the student's t-test for comparison between two populations. It is the most widely used two-sample test when the assumptions of its parametric equivalent, the t-test are not met (Berryman et al., 1988) This procedure is especially suited for situations where the distribution of the data is unknown and the sample size is small. The basic assumption for this test is that there are independent random samples collected from two populations. The test uses a rank sum procedure for testing that the two populations are identical but not necessarily normal. It makes use of the sign and the magnitude of the rank of the differences between pairs of measurements.

The test can be useful for situations in which truncated observations (e.g., below the limit of detection, BDL) are included in the computation of the test statistic. This method makes very efficient use of the information contained in the less-than values because it avoids the arbitrary assignment of fabricated values (required for parametric statistical tests when values are reported as below detection limits). Because the choice of the BDL value is arbitrary without some knowledge of instrument readings below the reporting limit, estimates resulting from simple substitutions are not defensible.

Kruskal-Wallis

The Kruskal-Wallis test, a nonparametric alternative to ANOVA tests, represents an extension of the rank sum test (Mann-Whitney) for the comparison of more than two populations. Again, both methods (Kruskal-Wallis and ANOVA) have various strengths and weaknesses which are highly dependent upon the actual distribution of the data.

As soon as the statistical data base has been developed, FMC and Simplot will select the appropriate statistical method and notify EPA Region X in writing.

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